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[OFFICIAL NOTICE.]

Annual Meeting, American Gas Light Association.

LAWRENCE, MASS., July 29, 1889.

Section 12 of the Constitution is as follows:

"12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on."

To the Members of the Association: Gentlemen—The Seventeenth Annual Meeting of the Association will be held at Baltimore, Md., on Wednesday, Thursday, and Friday, Oct. 16, 17, and 18. The headquarters of the Association will be at the Carrollton Hotel, which is conducted on the American plan. The meetings of the Association will be held in the Concert Hall of the Concordia Building, on German street near Eutaw.

Members should secure rooms at the hotel by writing in advance to the proprietor. The rate will be $3 per day. Past experience should induce the members to write well in advance for hotel accommodations, and to be very explicit in stating what kinds of rooms are desired. If the members would adopt the further precaution of inclosing in their letters to the hotel proprietors a properly addressed and stamped return envelope, with a request that the writer be informed whether he can secure such accommodation as he desires, much annoyance might be prevented. In the past, members have written to the hotel selected as headquarters requesting that certain kinds of rooms be reserved for them; but the hotel people could not fill the requirements, and had booked them for rooms of a different kind, without notifying the applicant of the change. The members, presuming that silence means consent, come to the meeting expecting to find reserved for them such rooms as they had bespoken, and failing in this have been disappointed. If the members would adopt the hint already given, and request an answer to their applications, trouble on this score might be prevented. In addition to the Carrollton there are other first-class hotels to which members can go if they desire; notably, Rennert's and Mount Vernon, both of which are conducted on the European plan.

The details of the programme for the convention have not as yet been entirely determined; however, it can be stated that the convention will be entertained at dinner the second evening of the meeting, and the last day will be devoted to sightseeing. Further details will appear in due course. That we will not famish for want of mental food is evidenced by the following list of essays to be read at the convention:

"Fuel Gas," by Walton Clark.

"Gas Coals of the United States," by H. C. Adams.

"Care and Operation of Gasholders," by C. L. Rowland.

"Water Gas," by F. H. Shelton.

"Leakage and Condensation," by E. C. Jones.

"Purification of Gas from Kansas Coals," by B. E. Chollar.

"Conduct of the Electric Light Business in Connection with the Gas Industry," by W. H. Pearson.

"Advantages of Supplying a Mixture of Coal and Water Gas," by T. G. Lansden.

"Some Thoughts on Fuel Gas, Induced from Practical Experience in the Distribution of Natural Gas," by John Young.

As in years past, I would advise the members to keep these subjects in their minds; to collect such data in relation thereto as they may be able, and to come to the meeting prepared to discuss these themes.

One word as to the question-box. The Secretary frequently hears the statement that the question-box, if properly used, would be the most useful part of our meetings. If this part of the literary programme of our gatherings is not properly conducted the Secretary would be glad to receive advice from the members, and he will do his best to put into practice any suggestions which may be offered. Members have in years past been invited to send in their questions in advance, so that arrangements may be made to have some one prepared to discuss each conundrum propounded. This invitation is again renewed. I would be very

glad to have questions for the box sent in as soon as possible, in order that they may be published in the official notices of the meetings—it is hardly necessary, I presume, to add that the names of the questioners will not be published.

In conclusion, I would remind those thinking of joining the Association at the coming meeting, that under the new Constitution it is necessary that all applications for membership should be in the hands of the Secretary at least ten days prior to the date of the meeting.

Let us hope that the 17th annual will far surpass its predecessors in the volume of attendance and the importance of its discussions. We have on our roll many names the owners of which seldom appear at our conventions; that the absentees thus miss many pleasant hours, and the companies they serve much useful and valuable information, will, I think, be the unanimous verdict of those who habitually attend our gatherings. Respectfully, C. J. R. HUMPHREYS, Sec'y.

BRIEFLY TOLD.

THE MOVEMENT FOR MUNICIPAL LIGHTING STATIONS.—It was supposed that the decisive rejection by the State Legislature of Massachusetts of the measure introduced by representative Mellen, of Worcester, empowering the cities and towns of that State to operate municipal lighting plants, would hinder the projection of such schemes in other States; but that supposition was not well founded, in view of subsequent disclosures. A change in the plan, however, has occurred, in that the developments in this direction seem now to be local rather than general—that is, the effort is being made in Council and Aldermanic boards, instead of in the State legislative arenas. This perhaps may be accounted for on the ground that the former—like the pauper—we have always with us, whereas the latter are "open" during but a portion of the year. The latest agitation of this nature that we are cognizant of is reported from St. Paul, Minn., where (on the 30th ult.) Mr. E. V. Smalley, of the Chamber of Commerce—the matter was first broached in the Chamber, with the intention of subsequently interesting the City Council in the investigation—secured the passage of a resolution for the appointment of a committee of five to inquire about the reasons that caused gas to be sold there for a higher figure than that which ruled in other large cities, and also to determine whether it would be in line with economy for the city to purchase and operate the St. Paul Gas Company's plant. The committee having been appointed, the first session was set for the 2d inst., and the only witness examined was Mr. Crawford Livingstone, of the Gas Company, whose testimony was exceptionally interesting—even though it was not calculated to give ease and confidence to Mr. Smalley's committee; for the witness gave facts and figures going to prove that in the matter of her gas supply the "other" of the Twin Cities was not so badly off, after all. According to Mr. Livingstone the cost of gas to the small consumer was $2 per thousand, while large consumers paid but $1.50; the average rate, as shown by the Company's books, being $1.70. Having stated the prices in Cincinnati and Cleveland, Ohio, Indianapolis, Ind., and Omaha, Neb., the witness said that the average for 96 companies in Pennsylvania was $1.74, that of 115 companies in New York being $2.20. In respect to this State, however, it should be noted that if 24 very small companies—whose output had little or no influence on the total output catalogued while their rates had a decidedly marked effect towards increasing the average sales' rate figured out—had been omitted from his calculation the selling average would be brought down to $1.80 per M. Continuing, Mr. Livingstone said that the St. Paul Company, having a duplicate generating plant, supplied coal gas in winter and water gas in summer, this plan being adhered to because the extremely cold weather experienced in that locality in the winter season caused it to be difficult to supply an even grade of lighting vehicle in water gas. He (the witness) said it was a mistaken idea to suppose that water gas could be made cheaper than coal gas could in St. Paul, for, as a matter of fact, the former cost 5 cents per thousand more to produce than did the latter. This disadvantage was counterbalanced in the summer season, because then they could work more closely up to the varying conditions of the demand with their water gas apparatus. He said that while the Company controlled the Westinghouse and Thomson-Houston types of electric lighting for the St. Paul district, and although the tendency in cities, as a rule, was towards the adoption of electric street lighting as a permanency, the St. Paul Gas Company did not find any profit in such supply. He did not think that incandescent electric lighting was likely to interfere materially with the progress and prosperity of the gas business; and, in fact, believed that incandescent electric supply was diminishing rather than increasing. Manager Livingstone concluded his temperate and coherent testimony by explaining that the average return received by the shareholders in his Company, since the date of its formation in 1857, was rather less than ½ per cent. per annum. The committee seemed to have been sorely taken aback by the nature of the evidence elicited, for on the conclusion of Mr. Livingstone's examination they adjourned, subject to the call of the Chair.

A SCHEME FOR MUNICIPAL CONTROL AT ST. LOUIS.—Some weeks, if not months ago, certain parties appeared before the authorities of St. Louis with a proposition at once novel and rascally, which we did not think would receive anything like serious consideration, hence made no mention of it all. It seems, however, that the scheme in all its richness was ratified by the House of Delegates on July 30, and that it is now before the Council, with something like a fair prospect for a favorable verdict on it there. Through the courtesy of a correspondent we are enabled to present the following summary of the measure. We give it without comment, other than to remark that it is about as barefaced an attempt at plunder as it could possibly be. Our correspondent writes: "In the bill passed July 30 in the House of Delegates, it is specified that the city shall enter into a contract with Geo. F. Branhan, Jas. B. Johnson and their associates, when incorporated as the St. Louis Gas Works Company, to erect, construct and fully equip a gas works in that city, to be leased to the city for a term of thirty years, at a rental of $225,000 per year (5 per cent. on $4,500,000, the estimated cost of the plant). The plant shall be held and enjoyed by the city for a term of thirty years, at the end of which the city shall have the option and right to purchase the plant at an upset price of $4,500,000, provided the city shall elect to make the purchase not less than one nor more than two years previous to the expiration of said term, and shall give due notice thereof to the owners of the plant; failing in which the city will at the expiration of said term deliver and restore to the possession of the owners the entire plant, with the right and privilege to operate it for a period of fifty years thereafter. All repairs, improvements, betterments, extensions, etc., necessary for the good condition and satisfactory operation of the works during the term of years mentioned, or necessary to keep the plant abreast with the city's growth, are to be made by the city and are to become a part of the plant and the property of the St. Louis Gas Works Company. The city is to keep the destructible part of the plant fully insured, and to pay all taxes levied on it during the term of the lease. The initial capacity of the plant is to be equal to the production of 1,000 million cubic cubic feet per year, and the conduit system is to be equal to the lighting of 200 miles of streets. The gas to be manufactured is either coal or water gas, or both, at the option of the city, and the sales rate thereof is to be regulated by the city during the life of the lease; provided that the rate to private consumers shall not exceed $1 per 1,000 cubic feet. Before the works are accepted by the city the company shall exhibit a clear title to the real estate on which the works are erected. It is also provided that the company may incumber the work or plant, or both, to such an extent as may be desirable, not to exceed the agreed value of the plant ($4,500,000) at an interest rate not to exceed 5 per cent. The projectors explain that by this means the 'rent paid by the city will at all times equal the interest payable on the company's bonds.' The construction of the plant must be begun within ninety days and be completed within three years from the passage of the ordinance. Then follow the usual stipulations as to how the work shall be performed, which is to be under the supervision of an Inspector (salary, $3,000 per annum) appointed by the city. It is next provided that the accounts of the gas works are to be kept separate from other city accounts, and at the end of each fiscal year the net revenue derived from the works, after payment of all rentals and operating expenses, is to be invested in bonds of the city, by which a sinking fund shall be created with which ultimately the city may pay for the works, if it elects to purchase them. In the event of a purchase the city will have the right to apply the whole fund so created toward payment for the works, but if the city does not purchase the works, but does permit them to revert to the owners, then the fund so created shall be divided into two equal parts, one of which the city may retain and the other shall be delivered with the works to the owners." Is not this a beautiful arrangement?

THE OFFICE WAS LOST.—Hardly has the smoke cleared away from the ruins of Seattle, Washington, when we are startled with the news that fire has again visited another of the most popular centers of that growing section of the country. Unless the telegrapher has greatly exaggerated the disaster (and we sincerely hope he has) the beautiful city of Spokane Falls is little more than a wreck, ruined by that most swift and terrible of ravagers—fire. We have authentic information that the plant of the gas company is intact. The office headquarters, however, were completely destroyed.

THE City Council of Elizabeth, N. J., has granted the managers of the Metropolitan Gas Company the right to open the streets (not to exceed 500 feet in length at any time), the Company to give a bond in $10,000 indemnifying the city from damages of any nature.

[Prepared for the JOURNAL.]

The Rotary vs. the Jet Exhauster.

By FREDERIC EGNER.

The question, "Which is the best exhauster to use—the rotary or the jet?" is sometimes put to gas engineers, and, from a long experience with both kinds, the author would give it as his opinion that the former is the one to be preferred. To this verdict, however, should be added that it is better to employ a jet exhauster than no exhauster at all, but not much. It may be remarked in this connection that, incredible as it may seem, it is a fact that there are still many persons who own or operate coal gas works and who are so densely ignorant (it cannot be supposed to be carelessness) as to their financial interests in this respect that they continue to make gas without an exhauster. Such people as a rule do not subscribe to even *one* of the several good gas journals, by reading which they could obtain much valuable instruction, that would make up to them in time a thousand-fold the money paid for the paper, or the time spent in reading it. And there are some persons who, even if they do get the paper, hardly open its wrapper, and never take the trouble to inquire about *any* possible improvements, but keep on in the old rut, until an electric lighting installation, or an opposition gas company, enters the field so unworthily occupied, to make it lively and "disgustingly expensive" for these fit disciples of the fabled Rip Van Winkle. There is a certain degree of satisfaction to the more progressive gas man when he hears of such a "Company" having been brought to grief; and the sympathy they get almost universally is, "Served them right."

But *why* is a rotary exhauster to be preferred to a jet? The jet exhauster costs much less; it has no parts to get out of order; requires no engineer—anybody can run it who can manage a steam boiler—it will maintain a vacuum and work against pressure within reasonable limits, and many are in use. "Say, what is the matter with the jet, anyhow?"

The questions could be answered in a practical way without going into details, by pointing to the examples shown in all the gas works of any magnitude, not alone in America but in the wide world. At such works it is a rule to employ only experienced, trained gas engineers as superintendents, and it will be found that they use the rotary exhauster and not the jet. If the jet exhauster was the best to use, these people would have it, and not the rotary. That would seem to be a common sense argument favorable to the rotary exhauster, but it is not a reason. But there are numbers of good reasons *why* the rotary exhauster should be chosen—after a party has come to the sensible conclusion to employ an exhauster; and these may be briefly stated as follows:

The jet is extravagant in the quantity of steam required as compared with the rotary, and, therefore, requires larger boiler capacity in the first place and more fuel all the time. The introduction of a jet exhauster alone to any works materially reduces the condensing capacity; for not only must we cool off the gas as before, but we have the heat of the steam besides to deal with, blown into it by the jet. Hence, to compensate for this necessary evil with a jet exhauster (if the persons in charge have the good sense to recognize it in time), when the jet is bought, a condenser for the same becomes a necessity; for few works have more condensing capacity than is actually required for the gas alone. If the cost of the jet condenser, the additional condenser and larger boiler capacity required, be taken together, it will be found that the first cost of the apparatus will not be so much in favor of the former, compared with the rotary, as was perhaps supposed. And the gas must be properly cooled, or a number of evils will be sure to follow. For instance—and we will name one only—if the gas is not cooled to a reasonable degree at least, most of the ammonia will remain and pass on with it, attacking and destroying brass service cocks and meter fittings. That "reason"—requiring only a few words to state—is a very serious matter, however, and worth careful consideration by the purchaser of apparently cheap exhausting apparatus. The rotary exhausters are now made so nearly perfect, with engine, and even the boiler, on the same bed plate, and with thoroughly reliable governors, that any one able to manage a steam boiler can also manage this machine as easily as the jet. The rotary exhauster is undeniably more powerful and positive in its action, both as a vacuum or a pressure pump, than the steam jet. The jet has no parts to wear out, and its superiority in that respect cannot be denied; but the rotary will work a long time, with ordinary care, before needing repairs. The author has known of one in a small gas works (operating only one bench of 3's in summer, and the same and one bench of 5's in winter) that has been running at least 12 years, without anything else having to be done to it other than to occasionally key up the brasses of the engine; and the same machine is still in use. But admitting that there is bound to be some expense from the wearing out of the engine and exhauster, it can be safely asserted that the cost of repairs will not come to $\frac{1}{10}$ as much in the long run as the loss caused by time spent in clearing stoppages occasioned by deposits of naphthaline, which are unquestionably induced by using the steam jet exhauster.

This is perhaps the most serious objection to the jet, although the other disadvantages are sufficient in themselves to affect the choice of an exhaust medium. In practice, therefore, it is customary to place the jet directly after the hydraulic main, because if we place it after the condenser we would lessen the illuminating power of the gas made, as will presently be explained. If we could place the jet exhauster after the gas condenser, the trouble with naphthaline could be greatly decreased, yet in that case we would reheat the gas suddenly from a temperature of about 60° up to 275° and more, and as rapidly re-condense it. This would cause the gas to deposit some of the hydrocarbons which would otherwise remain, and ought to remain, in it, thereby greatly lessening the illuminating power. Therefore, in practice, as was previously mentioned, we place the jet directly after the hydraulic main (which is the proper place for the exhauster in any case), and thereby not only avoid cooling the gas twice, but also, instead of reducing the illuminating power, are more likely to slightly increase it. That would be a positive advantage, of course, if it stopped there; but it does not.

Gas, as is well known, when first coming over from the hydraulic main, is heavily charged with tarry vapors, and in that state the steam of the jet is best able to act upon these vapors and disintegrate them to a great extent. The result is that the gas carries forward with it to distances of various degrees large quantities of hydrocarbons of the naphthaline series, which, at first, add to the illummating power, but for the most part are soon deposited in the mains and services after the gas has passed any wet or especially cool spot, and sooner or later cause stoppages everywhere. The difficulty is sometimes—not overcome, but put off for a future and may be very inconvenient time, by noting a few places about the works and main system where the naphthaline deposits are found to be the greatest, and periodically cleaning them out before a serious stoppage has occurred. That is the most advisable course to pursue when using a jet exhauster. The places most affected are usually the inlet to holders and the outlet to scrubbers, condenser and purifiers. But slowly and surely the deposits will increase elsewhere, until perhaps a very unexpected stoppage at the holder outlet shuts off the gas entirely, or the superintendent is kept busy chasing after stoppages all over his district.

These remarks are based upon personal experience, and are not at all overdrawn. But a jet exhauster is much to be preferred to no exhauster at all, and it is far better for the head of a concern to invest in a jet than to let his foreman or superintendent worry on without an exhauster of any kind. After having stated the reasons why a rotary exhauster is preferable to a steam jet, it may be asked, "But which of the many rotary exhausters in the market is the best?" If we call to our aid common sense, that question is easily answered. The cheapest is not, therefore, also the best exhauster. If material, workmanship and efficiency are equal, the best exhauster is that which has the fewest parts to get out of order, and these parts—such as journal bearings, etc.—most readily accessible.

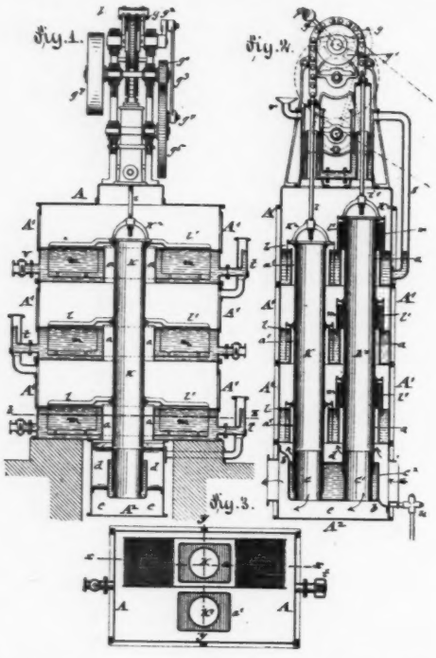
Ledig's Gas Washing Apparatus.

Amongst the patents recently granted we note the issue of one to Ernest Ledig (Chemnitz), who sought protection in this country for the leading features of an apparatus previously patented by him in Germany. According to the specifications accompanying Ledig's application (the patent number is 407,936), we are told that the invention relates to an improved apparatus for washing or scrubbing illuminating gas, so as to remove the ammonia contained in the same; and the device consists of an apparatus for washing illuminating gas, which comprises a closed casing formed of a superimposed section having gas channels, a gas inlet and outlet, vertically reciprocating boxes, having closely arranged parallel plates, and mechanism for imparting reciprocating motion to said boxes, as will be described.

In the accompanying drawings Fig. 1 represents a vertical, longitudinal section of the Ledig gas washing apparatus, on line $x\,x$, Fig. 3; Fig. 2 is a vertical transverse section of the same on line $y\,y$, Fig. 3; and Fig. 3 is a horizontal section, on line $z\,z$, Fig. 1. Similar letters of reference indicate corresponding parts.

Referring to the drawings, A represents the casing of the apparatus, which is formed of a number of superimposed sections A', of oblong shape, of which each is provided with two central vertical gas channels $a\,a'$, also of oblong cross-section. The sections A' are filled with water nearly to the edge of the gas channels $a\,a'$. At the base of the appara-

tus is arranged the gas-distributing section A^3, which is divided by a diagonal wall b into two parts, of which the upper part serves as the gas induction chamber d, while the lower part serves as the gas eduction chamber e. The diagonal wall b is provided with two vertical guide tubes CC', which are surrounded by a vertical casing C^3, that is filled with water, so as to form a hydraulic seal for the lower ends of the gas conducting tubes KK', as shown in Figs. 1 and 2. The gas conducting tubes KK' extend from the short guide tubes $c\,c$ through the oblong gas channels $a\,a'$, and are connected at their upper ends by fixed bails



or yokes K^2 with the suspension rods $i\,i'$, and a suitable motion transmitting mechanism at the top of the apparatus A, which latter imparts vertically reciprocating motion to the gas conducting tubes KK'. The motion-transmitting mechanism is composed of a link chain g, which is passed over a suitable sprocket wheel g', said link chain being connected to the upper ends of the suspension rods $i\,i'$. The shaft of the sprocket wheel g' is provided with a crank g^2, which is connected by a pivot-rod g^3 with a crank-pin g^4 on a gear wheel g^5, which turns in bearings of the supporting standards of the transmitting apparatus. The gear wheel g^5 meshes with a pinion g^6, to which rotary motion is imparted by a pulley g^7 on the shaft of the pinion and a belt applied to the pulley. The gear wheel g^5 and the connecting rod g^3, applied to the cranks $g^2\,g^4$, impart to the sprocket wheel g' a rotary reciprocating motion, and by the link chain g a vertically reciprocating motion to the gas conducting tubes KK', as shown in Fig. 1.

To each gas conducting tube K and K' is secured in each section A' of the apparatus an oblong sheet-metal box $l\,l'$, formed of a horizontal top sheet and two vertical side sheets. These side sheets form in each section of the apparatus, at both sides of the gas conducting tubes KK', channels of rectangular cross-section, which are closed at the open lower ends by the water in said sections, which forms a hydraulic seal for the sheet-metal boxes $l\,l'$. The boxes $l\,l'$ are provided with a large number of sheet metal plates m, which are arranged closely to each other parallel to the side walls of the boxes $l\,l'$, so as to form a large number of narrow passages between them. In each section of the apparatus are arranged, sideways of each other, two pairs of sheet-metal boxes $l\,l'$, which are so arranged on the gas conducting tubes KK' that when the boxes of one tube are entirely submerged into the water of the section the sheet-metal boxes of the other tube are lifted almost entirely above the level of the water in the section. When, therefore, the gas conducting tubes, with their coupled sheet-metal boxes $l\,l'$, receive an alternating up-and-down motion by the motion-transmitting mechanism described, it is obvious that the submersion and washing off of the plates in the boxes take place at regular intervals, while the gas passes in a free and unobstructed manner through between the plates, as the cross-sectional area of the passages in each box is equal to that of the other box in the same section of the casing.

The gas, which is introduced into the lower part of the apparatus, is compelled to pass in upward direction from the lower to the upper part, so that it takes its course successively through the channels $a\,a'$ and the passages between the plates of the sheet-metal boxes $l\,l'$ of all the sections A'. As the sheets are kept moist by the repeated submersion into the water in the sections of the apparatus, the ammonia gas contained in the illuminating gas is thereby washed out of and absorbed by the water in said sections. When the gas has arrived in the uppermost section, it is returned through the two conducting tubes KK' to the eduction chamber e, and conducted off from the same perfectly free of ammonia gas. As the weight of the submerged boxes is reduced during the submersion, while the unsubmerged boxes are increased in weight, owing to the water adhering to the plates of the same, it is necessary to apply to the crank shaft of the sprocket wheel g' a balance weight q, which is applied in such a manner that it does not act on the crank shaft when vertically above the same in the intermittent position of the alternating rising and falling tubes KK', but that it exerts only an action on the crank shaft while the tubes KK' are in their lowered positions, in which the balance weight serves to balance the submerged boxes and their gas conducting tube.

The water used for washing the gas is conducted into the apparatus through a funnel r to the hydraulic seals of the suspension rods $i\,i'$, and from the same, through a connecting tube s, into the uppermost section of the apparatus. The water is then conducted from section to section by means of overflow pipes t, which are located at the outside of the apparatus, the overflow pipes being arranged in such a manner that the specifically heavier solutions of ammonia salts are drawn off first. From the lowermost section of the apparatus the water used for washing is conducted into the chamber which is formed by the wall c^3 of the hydraulic tubes KK', and is then conducted off through the valved discharge pipe u.

In each section of the apparatus is arranged a discharge faucet v, for the purpose of removing the dirt collecting at the bottom of each section.

The supply of water is regulated in proportion to the quantity of gas to be washed, in such a manner that it remains nearly free of ammonia in the uppermost section, while the quantity of ammonia is gradually increased as the water passes through one section after the other, until the water, when finally discharged, contains about from 6° to 7° B.

The escape of gas from the apparatus is impossible, as the same is closed entirely up to the hydraulic seals of the suspension rods at the top of the apparatus. The hydraulic seals are tested for a certain maximum pressure, so that there is no possibility for the escape of gas.

If the apparatus is once in regular operation, it is hardly necessary to ever open the same, as the choking of the same is not possible if a sufficient quantity of water is constantly supplied.

From time to time it is necessary to draw off the dirt deposited at the bottoms of the sections, so as to keep the apparatus in good working order. If desired, the apparatus may be cleaned from time to time by forcing an extra quantity of water through the same.

The advantages claimed are: First, that the ammonia contained in the gas obtained from the retorts is entirely removed from the same: second, that a comparatively small quantity of water is required for washing; third, that a large quantity of ammonia water, of from 6° to 7° B., is obtained; fourth, that little or no increase of pressure in the apparatus takes place; fifth, that the apparatus takes up a comparatively small space, as all the parts are very compactly arranged, relatively to each other.

Some Account of the Papers Read at the Paris Meeting of the Association of French Gas Engineers.

At the annual meeting of the Societe Technique du Gaz en France (held on the 11th ult., in the Gas Pavilion at the Paris Exhibition) the paper list was a most interesting one, and the attendance of the sessions, despite the great "drawing power" of the Exposition itself, was well kept up. Premising our report with the remark that we are indebted to the London *Journal* for the same, we note that there were two prize papers—one on the "Radiation of Heat, Considered in its Applications to Lighting and Heating," by M. Gueguen; the other on "Ventilation by Gas," the joint production of MM. Coindet and Marchal. Mr. Gueguen, in his paper, has studied the subject of the radiation of heat which accompanies the combustion of gas in various kinds of lighting appliances, Having recapitulated the conclusions of previous investigators, he describes the apparatus employed by him in his experiments. Pending the fuller notice of the paper which we hope to give when it appears in its complete form in the publication over which its author exercises editorial control, it will be sufficient now to state the results obtained. M.

Gueguen finds that in batswing burners the amount of heat radiated per 100 liters (3.53 cubic feet) of gas is, on an average, 100 calories, or, in round numbers, one-fifth of the total heat due to the combustion of the gas. Burners surrounded by glass chimneys throw off, on an average, 140 heat units, in the form of radiated heat, per 100 liters of gas consumed, when the rate of delivery of the burner is 180 liters (6.35 cubic feet) per hour, and 175 units with a delivery of 250 liters (8.82 cubic feet) per hour. The amount of heat radiated with these burners therefore rises to more than one-third of the total quantity produced by the combustion of the gas; while with the old forms of burners made entirely of metal, and used with rather high chimneys, it would no doubt exceed one-half. These figures, which at first sight are somewhat disquieting, led the author to endeavor to find some means of decreasing the influence of calorific radiations. He considers successively the use of screens formed of plates of clear or ground glass (with or without the interposition of a stratum of air or water), and others of frosted glass; and he gives the preference to glass which has been coated with a thin layer of white gelatine. The conclusion to be drawn from M. Gueguen's researches appears to be that burner and lamp makers ought to become inspired with a desire to reduce to a minimum the quantity of heat radiated from both ordinary and high-power gas burners. With regard to the *memoire* of MM. Coindet and Marchal, the aim of the authors appears to have been to describe in detail various arrangements carried out at Rouen for the ventilation of warehouses and apartments in conjunction with gas lighting. After setting forth the general principles of ventilation, the authors explain shortly the methods followed by them to determine the quantity of carbonic acid and aqueous vapor in the air, as well as its temperature and the speed of currents. They then give a number of tables, accompanied by plates, containing the results of their experiments. In the first they show the effect, on the air of an unventilated apartment, of lighting by ordinary batswing, Argand and recuperative burners. In the next table the results are given of similar experiments carried out in an apartment where there was natural ventilation. Other tables contain observations relative to ventilation by means of lighting appliances, with various accessory arrangements used in different places; one showing what goes on in an unventilated school room lighted by gas. The authors, unfortunately, do not formulate any practical conclusions as the result of their investigations; confining themselves to the remark that gas is a very wonderful hygienic agent, inasmuch as it is capable of expelling from apartments where it is employed as a lighting medium deleterious products which, if not removed, would be injurious to occupants of such apartments.

Coming now to the ordinary papers, the first to be noticed is one by M. Lencauchez, in which the author takes a historical survey of the construction of retort furnaces from the commencement of the gas industry, and endeavors to show that during the past 20 years there has been really no new discovery in connection with these furnaces on the whole, but merely improvements in details. It will be interesting to see when the full text of the paper is published how far this opinion is justified by the author's collected facts. The subject of furnaces was also dealt with by M. Lauras, though from rather a different standpoint. He described a new double furnace erected at the Rouen gas works, in which the principal object sought was extreme simplicity combined with great solidity; the amount of recuperation desired being only such as would be compatible with this condition of things. With a setting of eight retorts, 8,000 kilos (7 tons 5 cwt.) of English coal were carbonized in 24 hours; the consumption of coke being rather less than 11 bushels per ton. The Company are so satisfied with the working of this setting that they are about to put up three double ovens of eight retorts on the same plan. Bearing upon retorts was a paper by M. Laurain, who described a new system of sealing the lids without luting. The soundness of the joint is obtained by means of a layer of asbestos placed in a groove in the head of the retort. The arrangement has been in operation during the past six months in the Troyes gas works to the entire satisfaction of its designer. Before leaving the retort house brief mention should be made of the system of tar firing described in the paper of M. Moirand. The author's arrangement allows of a change from coke to tar, and *vice versa*, at will. As the furnaces at the Genes gas works have been for several years fitted up with this alternative system of firing, there is nothing particularly novel in the plan. M. Moirand's communication is none the less interesting on this account, as he gives statistics as to the consumption of various fuels—tar, coke and breeze—to which we may have an opportunity of referring on some future occasion.

There were several papers dealing with the condensing and purifying arrangements of gas works. M. Melon described some condensing tanks which are so contrived as to allow of the separation of the ammoniacal liquor and the tar, and of the pumping of the latter by means of a draw-off well, which may be heated by a steam pipe. A new kind of scrubber—designed on what is claimed to be a "rational" plan—was brought under the notice of the members by M. Chevalet. The appliance consists of a cylinder or hollow column, the interior of which is fitted with cast iron channels or gutters, placed 10 or 12 inches apart, and perforated with a large number of holes. The space between these gutters, which support each other, is filled with some material presenting a large surface, such as wood shavings or coke. When water is run from the top to the bottom of the scrubber the gutters are filled and the material becomes saturated. But should the flow of water by any accident cease, the gas, in passing upward, still encounters the moistened surfaces of the coke or the shavings, on which it deposits its soluble properties. The author claims that by means of his scrubber he can obtain liquor of 7° 8° Beaume (say, 1.05 sp. gr.). The washing and purification of gas was dealt with by M. Alavoine. In the Beauvais gas works, of which M. Alavoine has charge, the gas issuing from the retorts passes first of all through a hydraulic main fitted with perforated plates on the system described some time ago in the *Journal*, next through a Chevalet apparatus, then through a Pelouze and Audouin condenser, and finally (after passing a Korting exhauster) through an upright condenser and a scrubber. It is washed with ammoniacal liquor—first, in the proportion of about 156 gallons per ton of coal, in the hydraulic main; next, at the rate of about 66 gallons per ton, in the Chevalet apparatus; and finally, and much more lightly, in the scrubber. M. Alavoine finds that the proportions of impurities taken out of the gas before its arrival at the purifiers are as follows:

	Ammonia, per cent.	Sulph. Hyd., per cent.	Carb. Acid, per cent.
Hydraulic main.....	65.93	43.40	13.12
Chevalet apparatus.....	20.88	15.51	4.55
Pelouze "	4.04	0.54	—
Condenser and scrubber..	2.80	5.42	10.08
Total.....	93.65	64.87	27.75

These results are stated to be due to the use of the ammoniacal liquor, which takes out a great deal of sulphureted hydrogen but little carbonic acid, and to the washing of the gas in the Chevalet apparatus and the scrubber. Another paper on the subject of the purification of gas, but dealing with the matter rather from the standpoint of the chemist than that of the gas manufacturer, was presented by MM. Aguitton and Debenoit. The object of the authors was to study the reactions which take place in the purifying material in proportion to the quantity of ammonia remaining in the gas after passing the scrubbers, and to ascertain how it is that the ferrocyanides, sulphocyanides, Prussian blue, and free sulphur are met with at different ages of the revivified material. According to the authors' conclusions the absence of ammonia from the gas renders inactive a portion of the oxide of iron by converting it into Prussian blue. In the case of Laming mixture, it is possible for the stuff to become inactive if the rate of passsage of the gas is sufficiently high, and the quantity of oxide below the proportion indicated in the formula for its preparation. In this case it would be necessary to force into the material the required quantity of sulphate or oxide of iron in order to insure good purification after two or three revivifications.

We have now to notice the papers dealing with the distribution of gas. First to merit attention was one by M. Avril, describing the working of a gasholder station at Bordeaux, and the loss of pressure observed at various points on the mains. There are at Bordeaux about 8,500 yards of pipes of large diameter from which there is not a single branch. This condition of things afforded an excellent opportunity for studying the loss of pressure sustained by the gas in its travel, and for verifying the formulæ on this point furnished by MM. Arson and Monnier. M. Avril summarized, in a series of tables and diagrams, the results of a number of experiments carried out with extraordinary pressures—13 to 26 inches of water. He found that M. Arson's formula approached nearer than that of M. Monnier to the results of his observations; and also that it is necessary, in practice, to apply some very important corrections to the figures furnished by theory. Bearing upon the subject of the loss of pressure is the question of leakage; and therefore M. Deleury did good service in describing his "dry isolator" for detecting escapes. The appliance may be employed as a substitute for the "syphon isolator" of M. Gibaut, which was described in the *Journal* some time ago. The new form of isolator possesses the double advantage of being inexpensive in construction and at the same time applicable in conjunction with existing syphon arrangements on the mains. Another leak detector, devised by M. Cruvellier, was described by M. Alavoine, who stated that excellent results had been obtained with it at Beauvais. Other gentlemen, however, considered the process (which consists in the employment of two preparations of chloride of palladium—one for large,

the other for slight escapes) complicated and uncertain; the method introduced and described at a previous meeting by M. Schauffler, which is based on the use of the same reagent, being regarded as more simple by those who had had an opportunity of testing it. The leakage of gas being admitted, the next thing is to endeavor to account for it– a task which was undertaken by M. Delahaye. This gentleman considers leakage—or rather, as he prefers to call it, following the English plan, "unaccounted-for gas"—to be attributable to condensation, to errors in measurement at the consumers' meters, to excess of consumption by the public lamps, and to defects in the mains. The author in his paper examined at length the extent to which each of the above-named causes contributes to the total quantity of gas unaccounted for, taking Paris as an example; and he came to the conclusion that the loss of gas from a properly-laid and well-maintained network of mains amounts to only half of the total, and that the remainder must be put down to condensation and to faulty registration at the consumers' meters. The adoption of thoroughly trustworthy measuring instruments and the employment of regulators in the public lamps, appear to be the only means of minimizing the loss of gas resulting from two of the causes indicated by M. Delahaye.

An allied subject to that discussed by M. Delahaye was brought forward by MM. Serment and Prat, who indicated the principal causes of the loss of electricity in connection with the supply of the electric light. One of these was, as in the case of gas, the imperfection of existing meters—instruments exceedingly delicate in construction, liable to frequent derangement, and recording results to a very small extent comparable with each other. An interesting account was given by M. Melon of the results of the first year's working of his system of gratuitous installations of gas at Lille. M. Melon described his plan at length in the paper on the best means of developing the consumption of gas, read by him at last year's meeting. An objection was raised to his system on the ground that losses might be incurred owing to some of the consumers not complying with the conditions laid down. The author replied to this objection by producing figures. Out of 443 consumers whose houses had been gratuitously fitted up during the year (representing 1,525 burners), the loss was reduced to 12, belonging to 4 consumers—really less than 1 per cent. It would therefore be absurd to bring this forward in support of arguments against the introduction of M. Melon's system.

The remaining papers may be conveniently noticed together. M. Delahaye, in a communication on the subject of the possible profits to be derived from electric lighting undertakings, stated that, according to statistics relating to upwards of 40 electric light companies in Massachusetts, the profits derivable from this industry are far below those realized in the business of gas supply—even to the extent of 2½ times less. Arc lighting is occasionally advantageous; but incandescent lighting does not return more than from 3 to 4 per cent. on the invested capital. Special interest attaches to this statement, from the fact that electric lighting in the United States must be considered to have passed its experimental stage. M. Delahaye also read a short note explanatory of a curve he had constructed to show graphically that, in the case of large companies whose share capital is all called up, and who have to raise money for extensions by the issue of bonds, when the price of gas has been brought down to a certain figure, further concessions to the consumers are not compensated by the resulting increased consumption. In constructing his curve, M. Delahaye took as a basis a total annual production of 300 million cubic meters of gas, with 5 per cent. unaccounted for, a net cost of 15c. and a selling price of 30c. per cubic meter. M. de Lachomette, in a short paper, supplementary to the one read by him last year, gave the meeting some practical indications as to the application of the process for the manufacture of sulphate of ammonia then described; and M. Melon, in another brief communication, advocated the use of soda in the place of lime in the treatment of ammoniacal liquor—specifying the conditions under which this substitution would be useful. M. Denayrouse made reference to the Clamond burner, which he stated had been so improved as to be able to rival its more fortunate competitors—notably the Welsbach light; and M. Serment described a safety burner furnished with a glycerine regulator so arranged as to automatically close the gas inlet in the case of a stoppage of the meter, and keep it closed until the burner tap had been turned. An arrangement for lighting and extinguishing all the public lamps in a town by means of regulators at the works was brought forward by MM. Grebel and Croc. A flash-light would necessarily be required in each lamp; and unless the lanterns were specially constructed to resist currents of air, the accidental extinction of the jet by a high wind would be a contingency extremely likely to arise and interfere with the efficient working of the system. M. Lichtsfousse explained the construction of a transparent calorific screen devised by him, consisting of a layer of water spread over a plate of glass, having its edges upturned so as to retain the liquid, and suspended beneath the light at a distance varying according to the intensity of the latter, the diameter of the screen, and the width of the projected beam sought to be obtained. The question of the analysis of gas was discussed in great detail in the paper of M. Egraz; its photometrical examination was dealt with by M. Salanson, who studied the corrections necessary in order to render observations comparable with each other; and its use as a motive power was incidentally touched upon by M. Ravel, in a few verbal explanations offered by way of comment on two reports, by M. Lenoir and M. Monnier, on the motor bearing his name.

It will be obvious that the foregoing abstracts merely indicate the nature of the subjects brought before the members, and give a general idea of the way in which they were dealt with.

Is it Desirable to Resort to the Use of Wrought Iron Pipe and Fittings?

Mr. F. J. Beesly, in answering this question at the Pittsburgh meeting of Master Plumbers, said:

It was with great anticipations of pleasure that I read the circular issued by our committee, containing sixteen most fruitful subjects for essays. I find among those subjects enough suggestions to guide a man from the cradle to the grave, as far as plumbing matters are concerned, and, I would say, if it were not a plumbers' circular, to guide him to celestial portals when he dies.

I had hoped to find one subject with which I was familiar, and which has long interested me, and that is, "Which is the most serviceable appliance, a combination sofa and bathtub, or a folding bed and refrigerator in one?" I am from Kansas City, where we have everything the best of its kind, and where the weather just now is as hot as any in the Southwest; consequently I incline to the folding bed and refrigerator. But, inasmuch as I do not find the interesting and important question among the subjects proposed, I have chosen that numbered eight in circular·

"In view of the fact that the sanitary regulations of municipal bodies are requiring the cast iron soil-waste and ventilation pipes to be air-tight is it desirable to resort to the use of wrought iron pipe and fittings?"

What is the necessity for substituting wrought iron for cast iron pipe for soil, waste, and ventilating purposes in order to make the same air and water tight? There is no doubt that wrought iron pipe can be put together perfectly tight; so also can cast iron pipe. It is being done successfully every day. Joints made with lead and oakum will not be tight, however, unless pains are taken in packing the oakum sufficient to caulk the lead against, without driving more or less of it into the pipe, thereby having nothing against which to pack the lead, and the use of lead free from solder; nor will a screwed joint be tight unless the threads are perfect and tightly screwed together. This, joint, however, has the advantage over lead in the fact that it will soon rust tight, and the longer it stands the tighter it becomes. A lead joint in cast iron pipe is liable to become loosened from the following causes: Unequal expansion and contraction, settlement of walls, floors, and beams, from which pipes are often hung and dependent for support. To what extent such settlement affects cast iron soil and waste pipe, well constructed to begin with, I cannot say, but offer it as my opinion that to all intents and purposes it is unaffected by such settlements as usually occur in a building before the same is condemned and abandoned, when the cast iron or any other soil pipe would naturally share the same fate; so the real condition is of no importance so far as further use is concerned.

Wrought iron pipe is very elastic, and will yield to strain without injury more readily than cast iron pipe; but this is of no special importance in this particular case, as we do not construct soil pipe to support buildings nor to keep floors from settling, nor would it do if we did. Therefore, cast iron pipe is as good as wrought, so far as trouble from settlement is concerned, according to my judgment.

The weakest part of using wrought iron pipe with threaded joints for house drainage purposes is the impossibility, or impracticability, of protecting that part of the screw thread that will not go into the fitting, leaving half an inch or more of unprotected pipe threads cut nearly in two by the action of the dies in cutting the threads, the threads being one-eighth inch deep, the pipe not more than five-sixteenths thick. You can readily see its weakness here. Cast iron pipe is also weak here, although in a different manner. When you cut a pipe you have no spigot left except on the end you do not wish to use, for the want of which it becomes very difficult to make a tight and satisfactory joint. The liability of shoving oakum through the space between the ends of

the pipe and the shoulder of fitting into the pipe, and the pipe pulling apart, is a serious objection to a joint without a spigot end, which should and could be remedied.

It is well known to practical plumbers that it is not difficult to make tight joints with lead and oakum, but it is equally well known to the writer of this paper that a large proportion of our best workmen do not give this department of the plumber's trade the attention its importance demands, but are so anxious to polish up and overcoat joints that catch the eye that the matter of perfectly tight soil and waste pipe is not considered at all. This, however, is not the fault of cast pipe, lead, or oakum, but is another illustration of how a plumber will put in three times the amount of time necessary to make good work either doing nothing or making the helper give the joints a few ineffectual taps with a calking chisel, or half doing the work himself, thereby bringing this excellent joint and pipe for drainage work into disrepute; and justly so, if they do not make this joint all it is capable of receiving at their hands, for it is a fact that I never yet have seen a soil pipe put up without reference to a water test that did not leak in a majority of joints, when the same became stopped, thereby putting a pressure of water on the stack.

There are no places or conditions under which a perfectly tight and satisfactory job cannot be constructed with cast iron pipe and lead joints, if the plumber doing the work will only expend one-half the time doing it that he does fooling around scrubbing up parts of the work that are not only unnecessary and uncalled for, but not wanted or paid for by anybody else than the man least able to afford such extravagance —the master plumber; for it is a fact that nine-tenths of the people employing plumbers, either by day or contract, do not intend to pay for fancy work at fancy prices. They understand the importance, in a financial sense, of having two-thirds of the plumbers in their city or town estimate, and thereby getting the closest possible figures and giving the work to their favorite, providing he will cut the figures still a little lower, to insure a good job and their lasting friendship.

But we are speaking about conditions for doing good work. I must say that wrought iron pipe is much more difficult to handle than cast when large sizes are required, unless buildings are specially constructed for its use. It is quite a difficult matter to revolve large-size fittings between joists set as they usually are, 16, 14, and 12 inches apart from center to center. Again, when soil pipes come in brick walls in chases left by the bricklayers, 4 x 8 at the commencement of the same and, as frequently happens, 4 x 3 at finish, or worse, covered after second story is reached and entirely abandoned. In addition to this the trimmers around chimney breasts on opposite side of walls, even, often make it necessary to do so much cutting away of mason work, in order to turn the fittings into proper position, that does not appear at all necessary when the work is finished; and as plumbers, as a rule, were never known even to make an attempt at replacing anybody else's work after serving their own convenience, it will become then a very expensive item in the use of wrought iron pipe that does not come with the use of cast iron pipe, to say nothing of the annoyance of explaining the necessity of doing so much cutting to the ever officious boss carpenter or architect, who always makes a "royal kick" whenever cutting is to be done.

The next point I wish to consider for a few moments is the difference of support given the water-closets in one system in comparison to that given in the other. To give this a fair explanation I will take you down into the cellar and ask you to accompany me in your mind's eye from the quarter-bend or soil-pipe ell, according to the kind of pipe you may be using, and get a few common sense facts. It has been claimed by some one that with wrought iron pipe a system can be constructed entirely independent of the floors or walls of a building, so that in the event of floors or walls settling the pipe would remain intact. The quarter-bend or soil-pipe ell, either one, must necessarily have a footing. Usually it is secured on the footings of the wall itself. Now, if one settles the other must follow. But suppose it has a separate foundation, it will be so near that of the foundation itself that if the wall should settle the other must be affected by its settlement. The water-closet being bolted to this by means of flanges free and clear of the floor, would not be affected by such settlement. Let us see how this looks to a practical man, forgetting for a moment the theoretical part of the plumbers' trade, of which there is so much, and still more to follow.

The closet set on a flange that cannot settle with the building must necessarily rise above the floor when it takes a drop of a few inches over night, if such a thing were possible. The closet tank is always fastened in some manner to the walls of the building; at least I have never yet seen any that were fastened to the soil-pipe, either cast or wrought. The closet bowls and connections being brass and earthenware, do not make a support capable of resisting very much strain, and being connected to the tank by a stiff lead pipe, made more stiff by numerous tags, the plumbers' delight (I say delight because they love to throw away valuable time so well that they often put on a lot of tags that are imperatively necessary, according to their own views, that never get a screw put into them or even see the necessity for one). I ask, what is to keep the connection to closets from breaking when the tanks settle with the walls and the closets remain intact? If this rigid construction is all that is claimed for it, which I doubt, heavy lead bends and traps, or other suitable closet connections flanged into lead safes and soldered, is the only safe and satisfactory manner of setting closets, to my way of thinking.

Even admitting that all buildings do settle more or less, the annoyance of coming just the right height to floor levels with wrought iron pipe is one of the most aggravating things connected with its use, either being 1½ inches too low or 1½ too high, more or less above the floor, and to change either involves taking down a whole length of pipe, sending it away to some power machine to be cut off and rethreaded, stopping further progress of the work until it returns, necessitating a delay of half a day longer, unless you are prepared with suitable tools to cut and thread 4-inch wrought iron pipe, which would be only half the machinery necessary, as I despair of ever educating the present generation of plumbers to even make the attempt to do this by hand power.

Cast iron pipe with lead bends have a leeway of several inches, which are taken advantage of in coming to floor levels, making it a simple matter to come to floor lines without trouble.

In the matter of expense as compared with cast iron pipe of the same size, everything else being considered, I believe it is 30 per cent. more costly, and may be 50, as applied to the soil pipe, extra time and fitting necessary to complete the work. I have had large and extended experience with the use of wrought iron pipe, for drainage purposes, all over this country, and while it is a good thing for the purpose, with the exceptions I have mentioned, and makes a tight and satisfactory job, I wish to say, without prejudice to the use of wrought iron pipe, that I see no reason to substitute it for cast iron, extra strong pipe and fittings. Standard pipe and fittings should not be used anywhere, except for vents above highest fixtures and high water levels.

I will say in conclusion that I believe good workmanship, honestly manufactured cast iron soil pipe, tested at factory and again in soil pipe stack with cold-water pressure, is good enough work for anybody or anywhere.

Electricity as a Factor in Moral and Social Development.

An enthusiast on the subject of electricity, writing to a contemporary, says that less than ten years ago a writer in Appleton's *Journal* said that it would be difficult to prove that any great scientific discovery, except it be the lucifer match, chloroform and vaccination, had ever done very much to reduce the mighty sum of human misery. Without disputing the truth of this statement for the time it was made, it is doubtful if it could be repeated to-day without making considerable additions to this already remarkable trio of scientific discoveries.

Of the numerous inventions, either made or perfected in the last decade, none have been more useful in the everyday life of the rich and poor alike, than those that relate to the practical applications of electricity. No other class of inventions has been so productive of good to all classes of society, or has become so quickly and so thoroughly an inseparable part of our civilization; and it is the object of this paper to call attention to a few of the ways in which electrical inventions are contributing, directly or indirectly, to the happiness, the comfort, and the moral and social development of mankind.

No less an authority than Joseph Cook has said that one of the modern wonders of the world is the "speed of intercommunication between nations." Unlike some of the ancient wonders of the world, electricity, the medium through which the international communication is made possible, is something more than a marvel of human skill and genius. It is a useful invention—a necessity of modern civilization.

The electric telegraph in the time of the Pharaohs would have made the construction of the Egyptian pyramids an impossibility. Telegraphic communication with surrounding nations would have raised the desire for relief from oppression, and placed the means of freedom within the grasp of every toiler on those huge monuments. This Egyptian wonder is but a monument to the slavery and oppression of thousands of the human race, while the electric telegraph, more worthy the name of wonder, is daily, yes hourly, lending its aid to relieve the sufferings and miseries of mankind. A single example from our own country will illustrate. The dreaded pestilence steals upon a Southern city, and for the safety of their fellow-men all passenger transportation

is cut off. No inmate of the stricken city is allowed to go beyond the city's gates to solicit aid or to tell of the city's needs. But the electric telegraph comes to the rescue, and in a hundred cities of our land the daily papers tell to millions of our readers the trials and sufferings of the unfortunate city, and before another day is passed an abundance of medical aid, food and money are on their way to the relief of the victims of the scourge. The sufferings and privations that would follow a conflagration or a winter's storm in the far Northwest, are largely averted by the speedy relief made possible by electric telegraph.

The local telegraph systems in our cities, for the use of the firemen and police officers, increase the security of property and life, and add to the careful guarding of the public streets.

No modern inventions, not even the steam engine, is so conducive to the quick relief of suffering, to the rapid spread of intelligence among men, or to active and energetic business enterprise. Without the telegraph, the modern daily newspaper would be an impossibility, and business would be stagnant compared with its present activity.

The telegraph, by making possible this speedy communication of nation with nation, of inland centers of trade with the cities of the seaboard, of every town and hamlet in the country with centers of intelligence and mercantile activity, has developed a trade that is world-wide, and contributed largely to the diffusion of knowledge and to the progress of civilization, by placing within the means of every man a daily record of the actions and tendencies of man in all parts of the world.

And what is the result of all this? It cannot do otherwise than tend to the broadening of man's ideas and sympathies, to the development of interest in other parts of the country, and in the work of other people, and to stimulate a healthy and commendable ambition with all intelligent men. To quote from a German writer: "Errors are cleared up and prejudices are overcome. Deficiencies at home are revealed by comparisons with what is seen abroad, and all that is recognized as better is imitated and improved upon."

Another of the modern applications of electricity that has added largely to man's happiness and comfort, and indirectly to his moral development, is the electric light. Save in rare cases nothing, that is reasonably under man's control, causes so much loss of life and property as fire. The man of business has welcomed the electric light as an invention which gives him reasonable relief from anxiety as to the destruction of his property by fire or to the personal safety of himself and family from the danger of either fire or robbers. The electric light is the greatest enemy of the thief, since it is almost impossible to escape recognition under its brilliant rays. It is a common saying that an electric light is more of a protection to life and property than the best policeman. The advent of the electric light has in some cities, by turning night into day, as it were, deprived the robber of his vocation, and either driven him to an honest calling or compelled him to seek a less enterprising community on which to ply his nefarious practices.

There can be no doubt that the reduction of the fire risk to a minimum by the invention and sub-division of the electric light, and its commercial success, has contributed, in a marked degree, both to the business enterprise and social happiness of the present decade. Ocean steamships and smaller crafts are now equipped with the incandescent light, thus giving increased safety to passengers and crew. In the home, the health and happiness of the members of the family are increased by the freedom from smoke and unpleasant fumes so common in other methods of illumination. Large churches, theaters, hotels, public halls and libraries, when lighted by this clear, brilliant light, are a source of admiration and renewed enjoyment to their patrons. In libraries especially is the comfort of the public conserved by the use of this steady light.

Investors and speculators are more ready to launch their capital in enterprises which make use of the various electrical inventions to give security from fire; and, indeed, it would be safe to say that no clear-headed capitalist could to-day be induced to invest his money in any large office building, or other structure, for public or private use, which was not fully equipped with the most approved forms of electric fire alarms and electric lights.

The use of the electric light in mining operations has been productive of much good, by diminishing the terrors of the intense darkness that exists in the subterranean passages, and by securing additional protection to the thousands of human lives that are daily exposed to the dangers of explosion of the so-called fire-damp. Surely no one will dispute the statement, that any invention which increases the pleasures of labor, by lessening its terrors and its dangers, should be classed with those that contribute to the happiness and progress of the race. At the present time by far the most active and promising field for the inventor and worker in electricity lies along the line of the transmission of power by means of electricity. The electric motor is second only to the telegraph in its importance as a factor in man's social development and progress. Since the time of Faraday's important researches and discoveries, inventors have sought a way of making this "new force" available for useful work. But it was not until the modern dynamo had furnished a cheap means of producing electricity on a commercial scale that the electric motor, as we know it to-day, came into general use.

The growth of the commercially successful and economical motor has been almost entirely confined to the present decade. Certain forms and sizes of the steam engine have found a most successful rival; and while, in most cases, depending primarily upon the steam engine as the prime mover, the electric motor has been found of immense importance, sometimes as a substitute for the steam engine, but more often as supplementing and extending its work. So recent is the advent of the electric motor and so limited, comparatively speaking, has been its application up to the present time, that its importance as a factor in the industrial progress and development of the times has not yet been realized. It is true that already it is applied to some hundreds of distinct operations, but even now scarcely a day passes that does not bring to light some new and useful application of the electric motor, in which it has proved superior, as a source of power, to the steam engine, or in which the use of the steam engine has been an impossibility. The remarkable flexibility of this method of the transmission of power and its almost limitless field of usefulness in the industries of a manufacturing country, are destined to make the electric motor, in less than half a century, one of the most important machines in any civilized country. Not ten years ago the utterances of those who dared to predict unusual success for the electric motor were looked upon as visionary and even absurd. But to-day its success has placed it far in advance of the predictions of the most visionary enthusiast of a decade ago.

By the invention of the electric motor power has been made portable, as it were, and its subdivion rendered possible to an extent hitherto unknown. The bearing of these two facts on the industrial and social delopment of our time is very important, and is worthy of careful study. Suppose that artificial light were not portable and could only be developed in large units. Obviously there would be a tendency to centralization in the localities where light was abundant, and could be easily and cheaply produced. Just so in any manufacturing country there is an evident tendency to "centralize" about any large source of power, such as a water-fall, since its transmission to any considerable distance has not been practicable or economical. It is true that to a certain limited extent the steam engine has made power portable; but it must be located near an abundant supply of water, and where fuel can always be obtained.

The electric motor is not limited by any of these conditions. It can be used at any distance from the source of power. It is as available for small power in the hands of an individual, as is the steam engine for large power under the control of a great corporation. It can be used economically in units small enough to drive a single sewing machine, and that in the house of the sewing woman; in short, it can be used in units of any size, in almost any place, and for almost any class of work. Such flexibility and adaptability are not possessed by any other source of power. And what does this signify? Simply this, that small factories can be operated almost as economically, so far as the cost of power is concerned, as large ones, and that many of the shops of modest size will spring up as rivals of the stronger and larger corporations; that the individual laborer who has been content to perform his work by hand, since no cheap power was available, will now utilize electricity as his source of power; that the factory-girl can, if she will, establish a factory of her own, and be supplied with power in proportion to her requirements; that the sewing woman can give her feet a much needed rest, and accomplish much more work in a given time. The demand of the times has been met, in the production of a source of power that is light, manageable, and, in an unusual degree, portable; and its use in the various trades of the world promises to make a factor of unusual importance in the social and moral development of our time. The moral result of a breaking up of the prevalent factory system could not be other than beneficial.

One important and special application of the electric motor must not be overlooked, and its bearing on the moral development of large cities is particularly worthy of notice. This is the application of the electric motor to street car propulsion. It needs no further demonstration that it is commercially economical and practicable. Rapid transit can be secured by this means, and already has been. On at least one line in this country a speed is obtained, in regular service, greater than that of the trains on the elevated roads in New York city. This improved method of rapid transit will place a city in closer and more rapid com-

munication with its suburbs, and have a tendency to relieve the crowded portions of the city of many families who prefer suburban homes, but who, for lack of the means of rapid transportation, are compelled to live in the densely populated quarters of the city.

To repeat a statement made at the outset, it would be difficult, indeed, to show that any other class of inventions has become so quickly or so thoroughly an inseparable part of our civilization. Electrical inventions have, in many ways, added to the strength and freedom of the individual, enlarging the field for the display of his powers and removing many of the obstacles to his moral and social development.

Mechanical Details of Electrical Machinery.

By A. J. Shaw.

In the practical application of electrical machinery to heavy work, more failures have resulted from lack of sufficient attention to mechanical details of construction than from any other single cause, if not more than from all other causes combined. Many electricians have never learned to look upon electrical machinery as anything more than laboratory apparatus. This may be due to the fact that they are scientific experimenters and not mechanics. This is not universally the case, however, for that some are fine mechanical as well as electrical engineers is shown by the character of their work.

In designing dynamos and motors for heavy duty a liberal margin should always be allowed for overloading, abuse and neglect, not only in the electrical portion of the apparatus, but in all the mechanical details as well.

Brush holders in which the brushes are held in place by small nurled head set screws; binding posts and flimsy connectors in or to which still more unsubstantial screws are expected to secure large conductors, are things which one would hardly expect to find on dynamos and motors from reputed first class makers; but one does find them, nevertheless.

Screws for connections should have square or hexagonal heads in all cases when possible, and set and binding post screws should have heads of the same shape. Screws requiring too frequent adjustment to make the use of a wrench undesirable should have liberal "wing" heads, or heads with cross pins. Nurled heads are an abomination, and should never be used on heavy machinery under any circumstances.

Screws to which connections are made by twisting the wire around them should be especially substantial, and should in all cases be provided with liberal washers.

In many engineering establishments it is one of the unwritten rules never to use a set screw less than, say, $\frac{3}{8}$, or a bolt less than $\frac{1}{2}$ or $\frac{5}{8}$ of an inch in diameter, except by "special dispensation." Even when the nominal load on the bolt is such that it might be carried by one that is much smaller, it has been found the only safe way to allow a liberal margin for contingencies; such, for instance, as a burly laborer at the end of a monkey wrench. Similar rules, modified as to the sizes of the bolts and screws to be used, should apply to heavy electrical work.

The "factor of safety" has been called a "factor of ignorance." It should sometimes be based on the ignorance of the user.

A motor designed specially for very heavy duty in a situation where anything more than the most ordinary care was not to be expected, was provided with connectors having $\frac{3}{16}$ inch slot-headed brass screws for securing conductors of No. 4 A. W. G. wire. It is, perhaps, superfluous to state that some of these screwed themselves off, instead of in, and had to be replaced with screws of iron.

Not only are liberally proportioned screws less likely to get broken, twisted off, or otherwise crippled, than the imitation fastenings often furnished, but better contacts, and consequently less trouble from heating, as well as a higher electrical efficiency, are obtainable, as the larger screws can be set down hard enough to exert a reasonable degree of pressure.

There is a motor in the market, the brush holders of which are pitted with brass screws about $\frac{3}{16}$ of an inch in diameter, with nurled heads about $\frac{1}{2}$ of an inch in diameter. One of these screws is supposed to be sufficient to clamp the brush securely in place. It did hold for a short time, when the brush slipped, was readjusted, and soon slipped again. This time a persuader was applied, in the shape of a pair of pliers, and the brush did not slip again.

When it became necessary to readjust the brush on account of wear, the set screw seemed disinclined to let go. On inspection it was found that the part of the screw between the point and the yoke, into which it was tapped, was somewhat larger than when made. The screw was finally gotten out, but the thread in the holder was ruined. It was then tapped $\frac{5}{16}$, and fitted with an ordinary case hardened, square head, set screw. This is not quite as handsome, from the apparatus maker's standpoint, as the original arrangement, but it is much more satisfactory to the man who runs the motor.

Set screws of brass, especially of the soft yellow brass rod commonly used, are a nuisance, as the points invariably upset as soon as any attempt is made to screw them up tight. There are situations in which iron or steel set screws are inadmissible, but they can be used in nine places out of ten in which those of brass are considered the only orthodox thing. Some makers of fittings are using them quite extensively, and it is certainly a start in the right direction.

The brass yokes which carry the armature bearings are sometimes very weak. This state of things arises, no doubt, from a laudable desire on the part of the maker to economize in the weight of brass, although in many cases it is due simply to bad design, as there is sufficient metal in the yokes to make them amply rigid, if it were properly disposed.

In motors from which the power is taken by a belt, this weakness is not always so perceptible; but when a pinion on the armature shaft is substituted for the belt pulley, the lack of strength may become only too apparent.

There is scarcely any single mechanical detail in a dynamo or motor in which weakness is more fatal than in the armature shaft, and yet this defect is not uncommon. On account of the high speed at which they run, armature shaft bearings are necessarily made very long. On this account, in order that they may not deflect in their own length, the diameter should be considerably greater than that due to the torque alone. A long bearing which springs is worse than a short one which is rigid; and a bearing which is amply large, as far as ultimate strength is concerned, may deflect very appreciably when subjected to the cross pull of the driving belt or the reaction of a small pinion.

In one case, that of a motor, the power of which was transmitted through a small pinion, as in street-car work, the bearing next to the pinion was worn very badly in a very short time, apparently from this cause alone—the weakness of the shaft. The low surface velocity of the journal due to the small diameter is very desirable, but is paid for too dearly when obtained at a sacrifice of strength. Any increase of velocity of sliding due to an enlarged diameter is partially if not entirely compensated for by the increase in the bearing area and the reduction of pressure per unit of surface. Switches are frequently constructed in a very unsubstantial manner, with insufficient surface and poor contacts. In a certain reversing switch, the insulating surface on which the sliding block runs, after leaving the last block of the rheostat, is of wood. This wood wears away quite rapidly, and the process is hastened by the temporary arc formed between the blocks on breaking contact, and finally the wood surface has become so much lower than the rheostat blocks as to render the operation of the switch somewhat difficult.

In a switch designed to control a motor attached to machinery in a foundry, the rheostat lever was connected to the hand lever by a light bar pivoted on the points of small headless brass screws. No provision was made for preventing the loosening of these screws except the tightness of their fit in the threads. Owing to a change in the arrangement of the machinery, this switch was not used. How long it would have remained in working order under the conditions necessarily obtaining in a foundry, ought not to be difficult to predict.

Sliding contacts can hardly be made too large; it is very easy to make them too small. On this account sliding contacts are preferable to rolling contacts, wherever it is possible to use them. Rolling contacts conveying heavy currents are troublesome things, as every one who has tried them can testify. This does not apply to the higher voltages and smaller quantities usual in street-car service.

Not all electrical machinery is open to the criticisms made in the preceding paper, as there is much which is fully up to the standard of the best mechanical work in design and construction.

How to Minimize the Generation and Reduce the Dangers of Dust in Mines.

Maunsell Mercier, in addressing the National Association of Colliery Managers (English) on this subject, said:

In complying with the request of the members of this Association, expressed at our last meeting, for a short paper on "Dust in Mines," I wish it to be understood that in giving this paper I do not propose, in so small a compass, to enter into the proofs of the dangerous properties of coal-dust, or to communicate any fresh experiments, but to content myself by giving a condensed account of its production in mines, with the means that have been suggested for preventing its generation, and the various proposals for destroying or counteracting its dangerous properties.

The primary object of this paper is to open the field for a general discussion on a question which requires the careful attention of all colliery managers. Legislation, in the Mines Act of 1887, having for the first time in mining history placed coal dust almost on a par with fire-damp, and this Act enforcing the observance of many new and expensive regulations as to blasting in dry and dusty mines, even where fire damp is not present or likely to be generated, we are, therefore, compelled to face the question, and to decide on the best and most economic method with which to conform to the requirements of the Act, and to endeavor to prevent the occurrence of those terrible calamities, explosions, or to mitigate their effect. It may be taken for granted that mining authorities are now agreed that coal dust does play, and has in the past played an important part in augmenting the intensity and disastrous effects of most explosions in mines that are dry and dusty, whilst many learned and experienced authorities in mining are strongly of opinion that "coal dust can of itself, under certain favorable conditions, cause explosions similar to those caused by fire-damp alone, or even more severe in character and effect." As a proof of which may be cited the Altofts Colliery disaster, whilst evidence of the former is amply supplied by the explosions at Seaham, Dinas, Trimdon, Grange, etc. To go into the proof of the theory is unnecessary, as it is dealt with extensively in the Report of the Royal Commission on Accidents in Mines, and also very fully and concisely in the valuable work, "Explosions in Coal Mines," lately added to the literature of the mining world by Messrs. W. N. & J. B. Atkinson, Her Majesty's Inspectors of Mines, which book should be read by all who are interested in so important a subject.

Now, in the first place, must be considered the cause of the large amount of this dangerous matter in most dry mines, and they will probably be summed up severally or collectively in the following: 1. The working and getting of the coal at the face. 2. Disintegration of the pillars and coal scattered in the roadways. 2. Leakage from tubs and boxes. The remedies of these evils may be found in the following: 1st. Mode of working, in which there is not much room for improvement. The longwall system is considered much superior to pillar and stall, as it does not leave any pillars to crush and disintegrate, which, when removed, produce a large amount of fine dust. 2d. In the mode of haulage and form of tubs there is, probably, the most room for improvement, as the systems in use in many collieries are very prolific in the generation of fine dust. The evils of these seem (*a*) the use of boxes made of green timber, which, after a few weeks' work in a dry mine, shrink and leave a wide space between the boards, through which the dust is continually falling; (*b*) the form of boxes in use in some of the South Wales collieries and other districts where the small coal is left in the mine. These boxes have the sides constructed of a latticework of iron only. The remedies for these disadvantages are (*a*) the use of dried and well-seasoned timber in the construction of wooden boxes, which should in all cases have grooved or covered joints; (*b*) the use of steel or sheet iron boxes, which should be fitted with wooden or india-rubber buffers, to reduce the shock caused by the boxes jamming against each other; (*c*) the systems of haulage at high speeds are probably the greatest producers of dust, and wherever possible these should be superseded by some form of haulage that can be carried out at speeds of from two to three miles an hour, such as endless rope or chain, with a double line of rails.

After having, as far as possible, removed the causes of dust generation (which remedies can be only partially successful), there must next be considered the means available for dealing with dust in mines. The first consideration must be its removal from the workings; and the next how to remove or destroy its dangerous properties. With reference to the former, the removal of the dust entirely is not practicable, for to be done properly it would require an army of scavengers to be kept constantly at work, and even then the finest and most dangerous particles would still remain; and unless water is copiously applied during its removal large clouds of fine dust in its most dangerous state will be constantly passing with the currents of air, and will be again deposited on the roof, sides and floor of the roadways. With reference to the consideration how to render the dust harmless, there have been several methods proposed. (1.) It has been proposed to raise the temperature of the intake air to the natural heat of the mine, it being claimed that all air entering the mine at a low temperature is gradually raised to the natural heat of the mine, by which operation most of the moisture is evaporated from the dust. This is impracticable, as it would be very costly to artificially heat the air some 20° to 40°, and as deep mines are at present much too hot for comfortable working; if the temperature of the mine be thus increased it would probably necessitate the paying of extra wages in the getting of the coal. The heated air would also probably affect the roof and sides of the mine, and decrease the quantity and efficiency of the ventilation, thus making the "cure worse than the disease." (2.) Strewing the workings with common salt or brine has been proposed, and is now used to some extent to keep the dust in a moist condition. It gives good results if used on the following basis: One pound of salt per superficial yard, applied once a week the first month, and once a month afterwards. Its use has the following disadvantages: Salt is expensive, costing about 9s. per ton (though if used extensively it could probably be obtained at a cheaper rate). The cost of labor in spreading the salt will be heavy, and additional weight of matter will have to be removed, this again adding to the already heavy cost of working mines, whilst it can hardly be considered efficient in damping the dust on the roof, sides and timbers, to conform to the new requirements of the Mines Regulation Act. (3.) The turning of exhaust steam into the air courses has been proposed; but anyone who has had to do with steam engines in a mine knows the havoc it works in a shale roof; therefore there is little probability of this method being used to any extent. (4.) The best and most practicable method is the watering of the roads by (*a*) water carts, or (*b*) laying of pipes in the haulage roads and main air courses, both of which methods have their advantages and disadvantages. These require very careful consideration, as it will be in these directions that the solution of the problem must be expected. (*a*) The watering of main intakes and returns by water-carts, of which there are several varieties, viz., ordinary water carts with outlet holes in the bottom; carts constructed on similar lines to those used in street watering, with a pipe at the back to diffuse the water through small apertures in the pipe. The best cart that has come under the writer's notice was constructed as follows: An ordinary water barrel mounted on tram-wheels, having at one end a hollow circular rose perforated with small holes round its circumference, and connected by gearing to a toothed wheel on the axles. The water was delivered into the center of the rose or disc, which, revolving very rapidly when the cart was in motion, diffused the water by centrifugal force against the roof, sides, and floor of the roadway. The disadvantages of the system are: 1st. The cost of conveying the cart about the mine (which would also interfere with the ordinary coal traffic). 2d. The cost of keeping a road constantly laid in the return air-courses. 3d. The water falling in one place only when the carts are stationary, which would have an injurious effect on the floor in that particular spot, and would also injure the roads by destroying the sleepers. In anticipation of this last we are indebted to a Mr. Hipkins for the excellent invention which we have before us to-day in the shape of a steel tram sleeper, which is already very largely used, and will, I am confident, shortly be largely used in dusty mines. The water would also seriously affect the other timber employed in supporting the roof and sides, and necessitate the adoption of steel or iron girders in place of bars; this change, which would entail a heavy first cost, would in the end prove of great assistance in enabling managers to work their mines more economically and with greater safety to the men employed. The second system consists of the laying of water pipes along the sides of the main roads and air-courses; and this appears the most feasible, if properly arranged, to conduct water from the surface or any convenient level in the shaft, the pipes being provided at suitable intervals with collections of small holes or apertures to diffuse the water, in the form of fine spray, into the roads. The distance between these sprays would have to be determined by practice, and should hardly be less than from 10 to 20 yards. This system, if properly carried out with a good head of water, possesses the following advantages: 1. The water can be turned on when the mine is not working, so as to cause no inconvenience to the men usually employed. 2. It does not require the keeping of permanent return airways. 3. After the first cost of pipes and fixing, it would not necessitate any heavy expense to keep in working order. 4. It would prove of great service in case of fire in the mine. 5. It can readily be connected with the working face and drawing roads by flexible tubing. 6. It will not injure the health of the men, as the atmosphere will not be saturated with moisture in suspension during the time the men are at work. 7. It can be so regulated that only the proper amount of water shall fall on the roadways to damp the dust. Its disadvantages are: 1. First cost of pipes and fixing, which will be heavy. 2. Danger of the small apertures becoming clogged with dust and dirt. 3. Danger of the pipes being broken by falls of roof and sides and lifting of the floor. These can be somewhat guarded against by having the pipes slung from the timbers, and providing expansion joints and stop cocks, so that the water can be turned off at any particular point or branch during repairs. 4. The necessity of having clean water free from all matter in suspension and accompanied by a good pressure, this again being of itself a counter disadvantage, as it necessitates the use of stronger pipes. 5. The necessity of having suitable settling tanks and girds to prevent

any solid matter entering the pipes; the same remarks as to the effect of water on the timber will apply also to this as to the previously mentioned system of water carts. In conclusion there are several points to be considered. 1st. Is there any necessity to damp the dust in any other than the main haulage roads and the return air-ways near the bottom of the upcast shaft? Messrs. Atkinson have clearly demonstrated that in the explosions of which they treat in the book before alluded to, "the blast did not in any of the instances quoted travel to any extent in the returns." They further draw attention to the established fact "that in explosions the blast travels against the air towards the downcast shaft" as the confirmation of their theory that "the dust in the return, being chiefly composed of shale and metal, does not transmit the blast." At the late explosion at the Altofts Colliery the same phenomena were observed, and this was the case at Mardy, etc. 2d. What will be the effect of damping the floor in mines that are subject to creep? Will the frequent slight waterings of the dust be sufficient to keep it moist without allowing water to affect the warrant? 3d. Will the spray at specified distances be effectual in rendering the dust on the sides and timbers harmless? 4th. The advisability of dissolving salt in the water to be so utilized; and will it be likely to crystalize and stop up the apertures, and if salt be spread on the roads how will it affect the men employed? 5th. The advisability of hanging a sheet of brattice cloth, saturated with water, over and in front of all shots fired in the coal or metal, as a preventive to the flame firing the dust. 6th. The advisability of reducing the velocity of the air in haulage roads by enlarging their areas, or providing additional roads for intake air. 7th. The advisability of adopting the remedy, suggested by Messrs. Atkinson, of separating each district by means of lengths of arching, to be kept quite free from dust by brushing and watering, and to so confine an explosion to the one district. There are many points that the scope of this paper has not been able to touch upon in so short a space which will probably be brought out in discussion. I have only endeavored to form a framework which can be better filled in by discussion, to which I trust it may act in a small measure as a guide.

Coal on the Pacific.

The past year was one of great prosperity to the coal interests of the Pacific slope. The Canadian collieries in the neighborhood of Nanaimo, in Vancouver Island, have been especially fortunate. Not only are the machinery and appliances for the handling of the product on a better and more extensive scale, but the quality of the coal is so superior that it commands a market in many foreign places against the local coal, with the disadvantage of a long sea passage, and an onerous tax. The Vancouver Coal Company, the Wellington and the East Wellington Collieries, all in the vacinity of Nanaimo, have sold during 1888 no less than 304,916 tons of coal in the city of San Francisco alone, being one-fourth of the total amount consumed—the Washington, Oregon, and California Collieries having turned out amongst them 950,238 tons, which is the largest output that has been made in the twelve months. The annual output from the Wellington and East Wellington Collieries since 1874 has increased each year since their start with only three exceptions, and the year 1888 showed an increase over its predecessor of 74,424 tons, although during the year there were two very serious delays, the mines being both closed on account of a dispute over the employment of Chinese labor, and the principal one in January from an explosion in the Wellington pit. The output for each year has been—

	Tons.
1874	81,000
1875	110,000
1876	139,000
1877	154.000
1878	171,000
1879	241,000
1880	268,000
1881	228,000
1882	282,000
1883	213,000
1884	294,070
1885	365,000
1886	326,636
1887	418,360
1888	437,784

The Vancouver Coal Company are now sinking a large shaft in their New North Field, adjoining the Wellington Colliery, and an entirely new coal field is about to be opened up at Comox, in the northern part of Vancouver Island, which promises to equal in every respect the Nanaimo coal. The Nanaimo *Free Press* announces that the railway connecting the Union Colliery in this new mining district with the wharves in Comox Harbor was complete, and the locomotive passed over it on January 5. A few miles from Nanaimo, in the middle of the strait between Vancouver Island and the main land of British Columbia, is Texada Island, which contains one of the largest and most available deposits of hematite that is known. It has recently turned out to have, in addition, immense deposits of copper ore, with which a large admixture of gold is associated, and there is at the present time a regular boom in mining leases in this new El Dorado. In less than a month 89 mining leases have been regularly applied for and filed on this little island, the crowd of prospectors and miners still flowing steadily on, exploring and digging in every direction. The new city of Nanaimo is profiting by all this industrial development, and is flourishing accordingly. During the last year the Esquimalt and Nanaimo Railway, 71½ miles in length, has been got to work, connecting the collieries at Nanaimo with Victoria, the capital of British Columbia, and the new naval station Esquimalt, the arsenal of Great Britain on the Pacific Ocean.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE Salmas City (Col.) Gas, Electric Light and Water Company is supplying about 20 arc lights (1,200-candle power each) on public account. The rate charged is $10 per month each, and a moontable is followed.

"LEAVENWORTH, KANSAS, Aug. 1, 1889.—During the last week in July a very important business transaction, the negotiations for which have been going on for some time, was concluded in this city, the affair being nothing less than the transfer of the entire business, property and franchises of the Leavenworth Gas Light Company to the Leavenworth Light and Heating Company. The sum reported to have been paid—and I believe it is about the real figure—was a round quarter of a million, which is equivalent to $250 per share (on a par of 100) for the old Company's stock. The purchase figure, however, as I understand it, includes the treasury surplus, which amounts to a good round sum. The Leavenworth Light and Heating Company was incorporated two years ago, and an ordinance was given it by the city, but the projectors never took any active measures to build a works, and in fact it was in the nature of an open secret that their purpose was to gobble up the old Company. While they have succeeded in doing this they have been obliged to pay a fair figure for the property, the sum, however, in my opinion, being, if anything, somewhat below the real value of the interests secured. I am more than gratified to be able to say that as the dominant party is Leavenworth all the way through, home capital still remains master of the situation. The newly-chosen management consists of: President, Hon. Edward Carroll—a go-ahead business man; Vice-President, Paul E. Havens; Secretary, McCown Hunt: Superintendent, John Gimper—whose retention prompts me to ask if they could very well get along without him. The Western fraternity will all join in the opinion that the old Leavenworth Gas Company owes a good share of its success to John Gimper, and the successor to the original corporation will in due course of time be laid under similar obligations. It might also be said that no change is to be made in the working staff. In all likelihood the works will be enlarged next season, but no particular importance attaches to the rumor that the Company will engage in the supply of a distinctively fuel gas. The real reason for the sale of the old Company is to be found in the fact that the Hennings (father and son) had determined to retire from the field—Mr. Henning, Sr., because of advanced age, and his son because of large business interests in Chicago that demanded close personal attention. If brains, money and pluck are to succeed, the fraternity may rest assured that the new Company will meet with good favor in this busy city.—R. T."

A PLUMBER in Sacramento, Cal., while hunting for a gas leak—he adhered to the naked light practice—in the residence of A. J. Turner, in that city, was ultimately successful. Mr. Turner puts his loss at $1,500.

MR. R. D. WIRT, Superintendent of the Independence (Mo.) Gas and Coke Company, has just returned home from Chicago, where he had been investigating improved processes of gas manufacture, with a view to reporting back to his Company whether it would be to its advantage to replace its present system of coal gas making by some one or other of the water processes now in vogue. While not cognizant of his determination in the matter of illuminating gas manufacture, we believe that he is unfavorably inclined to advising his proprietors to embark in the

manufacture of fuel gas, which could not be profitably purveyed in Independence at a selling rate of 50 cents per 1,000 cubic feet.

DIRECTOR WAGNER, of Philadelphia, is happy over the fact that the expenses of the Board of Gas last July were $31,595.60 lower than those for the corresponding period of 1888. He attributes the greater part of this saving to the economies brought about by the creation of the new Bureau of Street Lighting.

MR. G. L. GRAY, former Secretary of the Fargo Gas Light and Fuel Company—the sale of the latter to a syndicate having been recently made—is now in Aberdeen, Dakota, where he will construct a gas works. This place, which was not thought worthy of a location in the maps of 10 years ago, is the seat of Brown county, and can be reached by two trunk lines of railway. Its present population is about 7,500, and the assessed valuation of its property for purposes of taxation is returned at $1,750,000.

MESSRS. JOHN C. WATSON, Chas. W. Seymour and Frank P. Ireland have filed articles incorporating the Nebraska City Water and Light Company. The capital is placed "for the present" at $375,000, with power to increase it to $500,000. As stated, the object of the corporation "is the constructing, operating and maintaining in Nebraska City of a system of water works, together with a system of furnishing light by gas, electricity or other means, and to furnish electric power."

MR. HERMAN WILKIEMEYER is meeting with great success in his management of the Portsmouth (O.) gas works. We said such would be the case when mentioning his removal there from Lancaster.

THE Lawrence (Mass.) *American* evidently has an abiding faith in the capability of the cooks in the lighting district presided over by the Secretary of the American Gas Light Association; and we judge so from the following "ode" which it recently printed:

"How sweet to roam by the sad sea waves,
While no cares your mind harass;
And what joy to think, as you watch the stars,
That you are paying no bill for gas.
But, oh! what grief when you travel home,
And the meter your sad eyes meet!
You find that the cook has been holding "soirees,"
And has burned ten million feet!"

AT a meeting of the Lynn (Mass.) Council an order was presented (tabled for one week) which provided that the Committee on Fuel and Street Lights be empowered to get rates from the Lynn Gas and Electric Light Company for the supply of 800 incandescent electric lights, to be burned until 1 A.M. 20 nights each month, and 150 arcs, to be burned every night until 1 A.M., the contract to live for 5 years. It was also resolved that rates be obtained based on an all-night schedule of lighting.

THE Minnesota Street Lighting Company has been incorporated with a capital stock of $50,000. Its headquarters are to be at Minneapolis, and it is to have power to transact business outside the State. The incorporators are: W. J. Hartzell, G. A. Dole, and H. A. Magoon, of Minneapolis; G. J. Goodshall, of St. Paul; and W. A. Strayer, of Canton, Ohio. We believe the Company will introduce a new form of street lantern of the naphtha type.

AN attempt has been made to resuscitate the United States Gas and Oil Stove Company, of Jackson, Mich., which suspended business about two months ago. The plant, including patents and patterns, has been purchased by Messrs. H. H., D. S., and H. L. Smith and C. E. Barnard.

THE Washington (D. C.) Gas Light Company is putting in another large station meter in the building at the foot of M street, southeast. The volume of the Company's business this summer has astonished even its proprietors.

WRITING of the Washington Company puts us in mind of the pleasant fact, as stated to us by a visitor in the last week of July, that President McIlhenny exhibits marked improvement in health.

AT the annual meeting of the Pittsfield (Mass.) Gas Light Company the only change reported in the executive management was the substitution of Mr. W. G. Backus, who succeeds his father (deceased) on the Board of Directors. The regular annual dividend of 6 per cent. was declared, and some discussion was had on a proposition to improve the plant.

ON the 2d inst. a bill was filed, in the United States Circuit Court, District of Memphis, Tenn., by the National Gas Light and Fuel Company, of Chicago, against the Memphis Gas Light Company, in which it is alleged that defendant is infringing on complainant's patents for the manufacture of illuminating water gas. The damages are put at $125,000, and in addition to this sum complainant prays that an injunction shall issue.

THE 100-horse power Westinghouse compound engine and the 750-lamp incandescent dynamo recently installed by the Westerly (R. I.) Gas and Electric Light Company, was started on the evening of the 29th ult. The service was quite satisfactory.

THE contractors in charge of the construction of the new gas plant at Dalton, Ga., are pushing the work with vigor, and the pipe lines through Main, Waugh, King and Cleveland streets have been completed. It is predicted that gas will be turned on before election day.

CRUDE petroleum has been substituted for naphtha as an enricher at the works of the Keene (N. H.) Gas Light Company.

THE Milford (Mass.) Gas Company's new holder (capacity, 40,000 cu. ft.) is well under way. A rotary exhauster (capacity, 100,000 cu. ft. per diem) is also being put in place.

THE Bouton Foundry Company, of Chicago, has been awarded the contract for a new set of purifiers for the Jackson (Mich.) fuel gas plant. The new station meter is to be furnished by the Goodwin Gas Stove and Meter Company.

AT last the Chicago newspapers seem to be alive to the fact that a multiplicity of gas companies does not by any means serve as a guarantee of cheap gas. In support of this belief that the "change" is of record, we reprint the following editorial from the Chicago *Tribune* (July 29), a copy of which was forwarded us by a correspondent: "At the meeting of the City Council, on the 18th inst., an Alderman introduced an ordinance which proposes to give a corporation known as the Reform Gas Light and Fuel Company the right to tear up the streets of Chicago in every direction, and to lay new gas mains. The Alderman who thus introduced the ordinance failed to state who constituted the Company, or who were the moneyed men behind the ordinance. All he would say was that they are New York parties who have friends in Chicago. The ordinance was referred to the Committee on Gas. It was reported back favorably last Monday night—four days after it was introduced—and Ald. Ryan promptly moved that it be made the special order for one week later (this evening). The motion was concurred in. This haste is suspicious. Aldermen are not in the habit of rushing forward important ordinances of a praiseworthy character. Those members of the Council who have appeared as the eager sponsors of this measure are not noted for their zeal for the public good. Why, then, the haste? There is nothing in the character of the ordinance which would warrant unseemly hurry. It does not propose great or immediate benefits on the people of Chicago It proposes to charge $1 per 1,000 cubic feet for gas. The city is getting gas at that price now. The private consumers would be getting it at that price if the Mayor and Council did their full duty energetically. The Gas Trust was at the point of conceding gas at $1 per 1,000 a few months ago, when the Council and the Mayor weakened at the bluster of Mr. Billings and accepted the Trust's terms. The Reform Company does not propose to furnish the gas at $1 per 1,000 feet until three years from now. In the meantime the city's streets are to be torn up to lay mains, and the entire public is to be discommoded and annoyed. Before the three years have elapsed half the city will be illuminated with electricity, and all the present indications point to a lowering of the price of gas far below $1. Just before the annexation was completed a company obtained a franchise to lay mains in Hyde Park, by stipulating that it would furnish gas at 40 cents per 1,000. Hyde Park now constitutes three wards of Chicago. Why not let this 40-cent company go ahead and make the experiment? If it can furnish the Thirty-second, Thirty-third and Thirty-fourth wards with gas at 40 cents it can furnish the First and Fourth and the other 29 wards with gas at the same price. What is the sense of giving a $1 gas company a franchise until the 40-cent gas company tries its hand? The Reform gas ordinance ought to be voted down in the Council. If not it ought to be vetoed by the Mayor. It smells of jobbery, and looks like an own brother of the notorious Equitable Company, which tore up the streets

and laid mains that have never been used, because the Equitable was one of the first to surrender to the Trust. Does the Reform Company want a franchise now in order to have the privilege or price of surrender to the Trust? The *Tribune* and the people have no affection for the Gas Trust; but when we hit it we wish to hit an honest blow squarely between the eyes." This particular Chicago Editor does not seem to understand himself clearly; but in any event he has—unwittingly, however—managed to give quite a good descriptive title for the Hyde Park district Company, which he thinks ought to be permitted to proceed in an experiment on the residents of three wards of Chicago. A "40-cent gas company;" yes, that is about what it is. Nothing more; nothing less.

ARTICLES incorporating the Gas Improvement Company of North America have been filed in the office of the Camden (N. J.) County Clerk, by Messrs. Chas. P. Fiss and H. C. Potts, of Philadelphia; G. W. Close, of Rutledge, Pa., and Willing Wright, of Berlin, N. J. The stated objects are: "To purchase and acquire inventions, and applications for new and improved processes of manufacturing gas." The capital stock is $60,000, of which $1,000 has been paid in.

THE Chicago Gas Trust has notified its consumers that from and after November first all sales of coke will cease. This ought to be good news to the gas companies in the State that are not too far away from Chicago, which has always been a good market for gas coke—particularly so in respect to the house trade for that product.

A CORRESPONDENT says (as was in fact intimated in these columns at the time) that some weeks ago there was reason for believing that the syndicate now in possession of the Troy (N. Y.) gas supply had determined to manufacture all the gas to be used in the city proper, and in the suburbs of Lansingburgh and Waterford as well, at the works of the old Citizens Company. While this may yet be determined on, no decision can be made until the result of the test now underway is published. As near as can be ascertained the old Citizens plant never sent out over 330,000 cubic feet in 24 hours, whereas the maximum daily consumption could safely be put at 500,000 cubic feet. At first the intention was to dismantle the Hill street works of the old Troy Cmpany, but since then the proprietors have been discussing the advisability of permanently locating their manufacturing plant there; and this would seem to be in line with wisdom, for it would cost less to refit the Hill street works than it would to enlarge the Citizens plant. If the permanent works are to be located on the Citizens site, the Fitchburg Railroad Company will construct a spur coal trestle right to the premises. It is, however, likely that no decision will be reached because of the lateness of the season, and in that event gas manufacture will be carried on actively at Hill street, the Citizens plant being held in reserve.

IT is reported that Mr. William Lundy, well-known in this city from his connection with the Consolidated Gas Company, will attempt to secure a franchise for a gas company to be operated in opposition to the existing Hudson County Gas Light Company, of Hoboken, N. J. In fact it is said that the projectors of the scheme have secured a plot of ground in Guttenberg, adjoining the site of the Fairbanks Lard Refining Company, whereon to locate the plant. It is possible that the Lundy enterprise is intended to furnish gas only in the towns north and west of Hoboken.

THE annual report of John G. Brown, Gas and Water Inspector for San Francisco, Cal., discloses the fact that the lighting value of the gas supplied in that city during the year ended June 30, 1889, was as follows: San Francisco Gas Light Company, maximum, 18.89 candles; minimum, 16.97 candles; Pacific Lighting Company, maximum, 18.24; minimum, 16.95. The greatest number of street gas lamps lighted during the year was 5,249, and the cost of maintaining the same was $206,398.44. The cost of gas used in public buildings footed up to $18,564.44. The city in the twelvemonth paid $44,802.78 for electric lighting.

THE Citizens Gas Light Company (Jacksonville, Fla.) is adding to its works. The Company is doing a fairly good business.

WE continue to receive reports from various sections respecting damage done to gas works property by the recent heavy rains. This is especially so in the instance of New Jersey. On the 31st ult. the inadequacy of the main sewer culvert in Passaic street, Passaic, to take off the overflow caused serious damage to the retort house yards of the local Gas Company, and the Plainfield Company's mains were broken at several points by the rushing waters.

MR. CHARLES C. ANDERSON, who has acted as Superintendent of the Marquette (Mich.) Gas Light Company since 1875, has tendered his resignation to the proprietors, the same to take effect on the 31st inst. He intends to return to his former home at Lima, Ohio. The proprietors of the Marquette Company have always had the fullest confidence in Mr. Anderson's management.

THE proprietors of the Montclair (N. J.) Gas and Water Company are endeavoring to purchase the plot adjoining the works that was formerly owned by a Cincinnati capitalist. This property negotiation is probably the forerunner of important extensions to the Montclair Company's plant.

ELSEWHERE we report a proposition, recently made to the Council by the Lynn (Mass.) Gas and Electric Light Company, respecting the public lighting of the place. In that mention we omitted to state the prices proposed, which latter are: Incandescent lamps, $15 each per annum; arc lamps, 40 cents each per night.

AT the annual meeting of the Fitchburg (Mass.) Gas Company the officers chosen were: President, Rodney Wallace; Treasurer and Clerk, H. F. Coggshall; Directors, Rodney Wallace, Thornton K. Ware, Charles T. Crocker, Herbert I. Wallace, and Frank B. Shepley.

THE artesian well on the works of the Cambridge (Mass.) Gas Light Company, is drilled to a depth of 227 feet, and yields 3,000 gallons of water per hour.

THE Montpelier (Vt.) gas works are being "repaired" again; but if the truth were wholly told the plant at that spot is simply beyond repair. Reconstruction is Montpelier's only chance.

THE hearing granted the North Attleboro (Mass.) Steam and Electric Company, on the petition of the latter to supply electric light in the town, was held on the 1st inst., and much more interest was taken in the proceedings than was the case one week before, when a similar petition from the Gas Company was considered. The whole proceedings, however, were oddly concluded. Before the hearing was formally opened, the Selectmen inquired from Mr. J. C. Barden, who represented the Gas Company, if the latter had complied with necessary laws set out in Chap. 385, Sec. 1 and 2, which require that applicants for the right to operate electric lighting companies must first secure the assent of the Gas Commissioners. Mr. Barden said he did not so understand the law, and that his Company had not so applied. The hearing on the other Company's petition was then opened, and a similar question to that put to Mr. Barden was propounded to Mr. G. A. Adams, who appeared for the petitioners. He replied that his Company, while fully alive to the conditions of the law, had not applied to the Commissioners for permission, but simply proceeded in the manner pursued by the representatives of the Gas Company. This, of course, left the Selectmen no option but to rule both petitioners out of standing before them on the ground that the law had not been complied with. Both parties were allowed to withdraw their petitions.

AMONGST the interesting exhibits in the American section of the Paris Exhibition may be noted the display of Otis Bros., of this city, who have two Baldwin gas engines on show. The smaller one, of 2½-horse power, with cylinder, 5-inch diameter by 8-inch stroke, is applied for pumping. An especial claim for the Baldwin apparatus is its automatic working. Both the pump and oil feed are automatic by means of the vacuum produced by the stroke. The instruments are fairly noiseless, and the small dynamo actuated by a rubber pulley on the fly-wheel is a most novel arrangement. The other and larger engine, cylinder 7-inch by 12-inch stroke, shows 5½ brake horse power, and is used to supply current to 40 sixteen-candle power lamps. These engines have centrifugal governors, and produce an explosion with every revolution.

THE P. H. & F. M. Roots Company, of Connersville, Ind., enjoys a very good share of the patronage of the gas men, and its standard exhausters, blowers and portable forges are shipped to every section of the country. If evidence were needed to show that the Company prospers, we think the following will furnish it, which is a simple report of some of its recent shipments and orders: The Cleveland (O.) Gas Light Company took 2 exhausters (with engines on same bed-plate), capacity of each per day, 2,500,000 cubic feet; Burdett Loomis ordered 4 exhausters (engines attached) for East Liverpool, Ohio, each to have a capacity of 2,500,000 cubic feet per day; and the same gentleman ordered two similar exhausters to be sent to the Boston (Mass.) Gas Light Company; the Cincinnati (O.) Company ordered 1 exhauster, equal in capacity and

similar in kind to those above mentioned; and the Colgate Company did likewise; the Kerr Murray Manufacturing Company (Fort Wayne, Ind.) authorized the shipment of an exhauster rated to pass 300,000 cubic feet; the Hartford (Conn.) Gas Company took a machine of 2,500,000 cubic feet capacity; an additional order from Burdett Loomis was for a 1,000,000 cubic foot capacity exhauster, for Mt. Vernon, Ohio; and the Key City Gas Company, Dubuqe, Iowa, ordered an exhauster and engine on same bed-plate, with governor, pipe fittings, gas and bye-pass valves, the machine being rated to a daily duty of 600,000 cubic feet. Last week the Company shipped 2 exhausters and engines to the Chicago Gas Light Company, each vessel having a daily capacity of 3,000,000 cubic feet; and 1 exhauster and engine, with bye-pass valves, pipe fittings, governor, etc., was forwarded to the Ashland (Wis.) Gas Light Company. That looks like business.

THE articles of incorporation of the Flatbush (L. I.) Light and Fuel Company have been filed. The objects of the Company are to manufacture and supply gas for public and private purposes in the town of Flatbush. The capital stock is put at $150,000, and the incorporators are Charles G. Francklyn, G. W. Goddard and W. E. C. Mayer. There is not room enough in Flatbush for two gas companies, and the proprietors of the newly-organized Company will be apt to have this fact made patent to them sooner or later. The existing Company is controlled by the solid citizens of the town, some of whom are not easily frightened by the boasts of outsiders, and while they might be induced to part with their property, at a price equal to its real value, they cannot be persuaded to hand it over to speculators at anything less than that value.

THE stockholders in the Paterson (N. J.) Electric Light Company are jubilant over an announcement made 10 days ago to the effect that they were to receive a "quarterly dividend" of 1 per cent. on their holdings. As this is the first "quarterly" dividend declared we presume the holders of the stock ought to be jubilant.

THE Citizens Gas Light Company, of Wakefield, Mass., was organized in 1862, and Mr. Buchanan B. Burbanks has acted as its Superintendent since that time. It is needless to add that his management has been efficient.

THERE is trouble in the firm of Tweed & Andrews, of Cincinnati, O., well known throughout the West as builders of gas plants. One of the partners applied last July for the appointment of a receiver, but Judge Taft denied the motion on the ground that the firm was solvent. He gave the partners two weeks' time in which to adjust their differences, on the expiration of which period he would entertain a motion ordering the dissolution of the firm.

THE Springfield (Mass.) *Republican* is our authority for the following: "Several methods of producing what is termed 'electric' gas have been invented, the product being chiefly hydrogen, manufactured in different ways. A device for producing our common illuminating gas by electricity has been perfected in this city, and by a method which is said to be at once practical and cheap. The inventors are E. P. Holly, formerly connected with the Springfield Gas Light Company, W. W. Castle, Engineer of the Electric Light Company, and L. S. Dumoulin, formerly of the Electro-Dynamic Company, of Philadelphia. The first machine made is now in Wight's block, and although in an unfinished and unperfected condition, works successfully, and has proved the success of the scheme to the satisfaction of the promoters. Technically the machine is an apparatus by which oils or other volatilizable substances may be volatilized, or converted into a vapor by heat, through a novel method, creating heat by means of the passage of an electric current through some foraminous metal. To those familiar with the manufacture of illuminating gas by the present method, the sight of a little apparatus, occupying no more space than an office desk, sending forth gas enough to supply a whole manufactory with light, heat and power, is a surprising one. Yet it is claimed that this can be done, and the process is something as follows: A coil of foraminous metal is connected with an electric generator. By foraminous metal is meant metal that offers a good deal of resistance to an electric current, so that it is heated very hot and at the same time is not destroyed by the heat. This coil is in a metal retort, through the side of which the wires pass. A small stream of oil is led from an oil reservoir into a Bullard burner. This burner is in another pipe filled with steam and opening into the retort. As the steam passes through the pipe it forms a vacuum at the mouth of the burner and draws out the oil in a very finely divided condition, atomizes it, in fact, on the same principle as the atomizers on perfumery bottles. This atomized oil passes into the center of the foraminous coil and is volatilized into gas, and then passes out into a storage chamber. The oil which will be generally used is the crude petroleum, although any volatilizable substance of a like nature will do. The electricity may come from any constant source, preferably a small dynamo, and the current is to be so governed by a rheostat that the coil may be kept at any temperature. The steam is not a necessary part of the process, as air may be used. One advantage of steam is that the hydrogen of the steam forms with the carbon of the oil a pure hydrocarbon, which is better for the purpose. The chief advantage claimed for the process is cheapness of production. Gas can be manufactured by this process, it is asserted, for about 17 cents per M. A manufactory can have its own little gas machine, and this, it is claimed, will light, heat and furnish power to the whole building for less than one-half the usual cost, and the space required by the whole plant would not be as great as that now occupied by the coal piles round an engine house. The electric current required is what is known as a 'large' current with a low electro-motive force, and can be obtained, as in the case of the machine in operation now, from the electric light company, or from a dynamo. When a boiler is to be heated by gas produced in this way the retort is dispensed with and the gas burned directly as it is volatilized. No arch is needed under the boiler. But while this method may be used for making gas for any purpose, the promoters believe it will revolutionize the present method of making steel by doing away with the expensive regenerative chambers. These chambers, filled with firebrick, are heated to a very high temperature, and air heated in them melts the metal. By the new invention, however, the gas can be burned as it comes from the retort and produces a temperature high enough to melt the metal directly. Other desirable features are also claimed for this invention. Patents have been applied for both in this and foreign countries, and the inventors will immediately construct some more perfect machines." All of which is rather vague, if not decidedly mystifying.

ALMOST every Summer we have an account of the victimizing by robbery of some Eastern gas company, and this year the visitation seems to have fallen upon the Newton and Watertown folks. The office safe was broken open on the 3d inst., but the plunderers were rewarded with less than $100 of booty.

AMONG the gas companies using the Government Waterproof Paint Company's paints we may mention the following: The Boston, Roxbury, Lowell, Salem, Malden and Melrose, Adams, Marlboro, Cambridge, and Amesbury, Mass.; Exeter and Plymouth, N. H.; Thomaston and Rockland, Me.; Peoples, Citizens, and East River, Brooklyn, N. Y., and Poughkeepsie, N. Y.

IT is said that Messrs. R. P. and A. R. Flower, of this city, have purchased an interest in the Watertown (N. Y.) Gas Light Company.

THE contract for lighting the government building at Utica, N. Y., has been again awarded to the Utica Gas Light Company.

THE Brush Electric Light Company has advised the authorities of Baltimore that it will carry on the public lighting at the rate recently arranged by an ordinance of Councils. This means that the Company will accept 40 cents per light per night.

A RESOLUTION is now pending in the Salt Lake City (Utah) Council which provides for the extension of the charter of the local gas company for a period of 25 years. There is no doubt about its ultimate passage.

THE residence of Mr. Eugene Vanderpool, President of the Newark (N. J.) Gas Light Company, a few days ago was visited by a thief, who helped himself freely.

MONTREAL, Canada, is not fully satisfied with the public electric lighting system inaugurated there on the 1st inst.

THE Western Electric Company begun to supply public arcs on the streets of Galveston, Tex., on the 1st inst.

THE Equitable Gas Company, of Pittsburgh, has completed the laying of its mains from the north Murraysville field, and has turned on the gas into the big 36-inch main to the city limits. There are now four producing wells connected up with the Murraysville main, but the Company claims to have eight more in readiness to turn on as soon as it is necessary. The Company is now contemplating the advisability of going into the market and soliciting the domestic trade, in addition to supplying mills. The Carnegie line from the Murraysville field is to be enlarged this season. They will lay new mains from the field to the Edgar Thompson works, and are contemplating the extension of a line from the Bellevernon field to the Homestead Steel Works, which is now on the old Chartiers Valley line.

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MONDAY, AUGUST 12, 1889.

Naphtha Residuum as Fuel in Russia.

The British Consul at St. Petersburg says that naphtha residuum is being more and more employed as fuel in Russia. All the steamers of the Caspian, and many of those plying on the Volga, have for some time past used it as fuel. At the present time manufactories and railways are adopting it in the place of wood and coals. It is also being utilized for domestic purposes in stoves of special construction, ingenious specimens of which were exhibited last year at the St. Petersburg Naphtha Products Exhibition. By the employment of this new combustible a considerable saving is effected under the head of fuel. Some large manufactories in Moscow and its immediate neighborhood employ naphtha residue in their furnaces, because in addition to its great cheapness, it possesses the advantage of occupying less space than wood or coal for storage. It is kept underground in large cisterns, communicating by pipes with the furnaces, and owing to this method of storage it is also less exposed to danger from fire. It is established that the cost of naphtha dregs as fuel is about 35 per cent. less than that of wood and coal, and this, too, at Moscow, which is 1,500 miles distant from the source of supply at Baku, whence naphtha dregs are conveyed by water to Nijni Novgorod, and beyond by rail to Moscow. Several manufacturers of the province of Vladimir have also adopted the new combustible, and the railway lines existing in the Tambov and Riazan provinces are on the point of doing the same. During 1888, 54,000,000 pouds (867,857 tons) of naphtha residue were transported from Baku up the Volga, for use in the interior provinces and in those bordering the Volga. It is expected that in 1889 the supply will exceed 70,000,000 pouds (1,125,000 tons). In the northern zone of the empire wood will, it is stated, hold its own as fuel for some time to come. It is specially central, southeastern and eastern provinces of Russia that the employment of naphtha residuum as a substitute both for wood and coal promises to attain great proportions.

The Market for Gas Securities.

Early in the week inquiry for Consolidated gas in small lots sent the price up to 86¾, and to-day (Friday) the shares are bid for at 86¼, holders asking 87. It is reasonable to assume that next month, when speculators as a rule are on the alert for a fairly quick turn, Consolidated will cross the 90 line; for it is beyond the pale of doubt that a 2½ per cent. dividend will be declared for the last half of '89. Equitable is weaker, being at 120 bid, while a good round block of the stock could be secured for 122½. Mutual shows no change, although the undertone is firm. In Brooklyn the situation remains about as before, and the quotations given are but approximations or guesses. Chicago Trusts are at 58 to 58¼. The Wilmington (Del.) Company has declared its regular semi-annual of 3 per cent., and the Salem (Mass.) Company has made a similar return.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

AUGUST 12.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	86¼	—
Central	500,000	50	—	—
" Scrip	220,000	—	—	—
Equitable	4,000,000	100	120	122
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	116	118
Mutual	3,500,000	100	101½	103
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	60	70
" Bonds	15,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	107½	108½
Citizens	1,200,000	20	65	70
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	126	127
" Bonds	300,000		—	106
Peoples	1,000,000	10	74	76
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	88	91
Nassau	1,000,000	25	110	—
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	118	120
" Bonds	1,000,000	—	109	112
Out of Town Gas Companies.				
Boston (Mass.) Gas Co	2,500,000	500	240	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	170	—
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	58	58¼
Cincinnati G. & C. Co.	6,000,000	100	214	218
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal.			58	
Consolidated, Balt.	11,000,000	100	44¾	45½
" Bonds	6,400,000		107	107½
Hartford, Conn	750,000	25	120	130
Jersey City	750,000	20	175	180
Laclede, St. Louis, Mo.	2,000,000	100	140	—
Louisville, Ky.	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	48	51
" Bonds.	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal.			35	35½
Peoples, Jersey City		—	60	61
" " Bonds.			—	—

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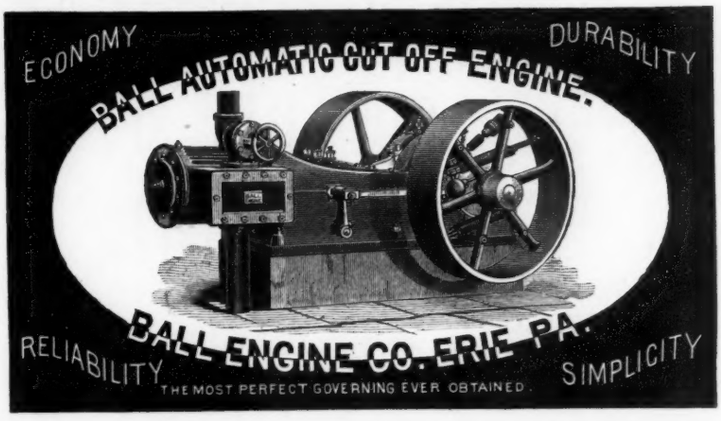

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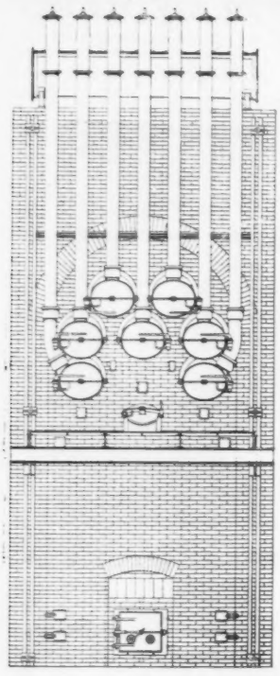

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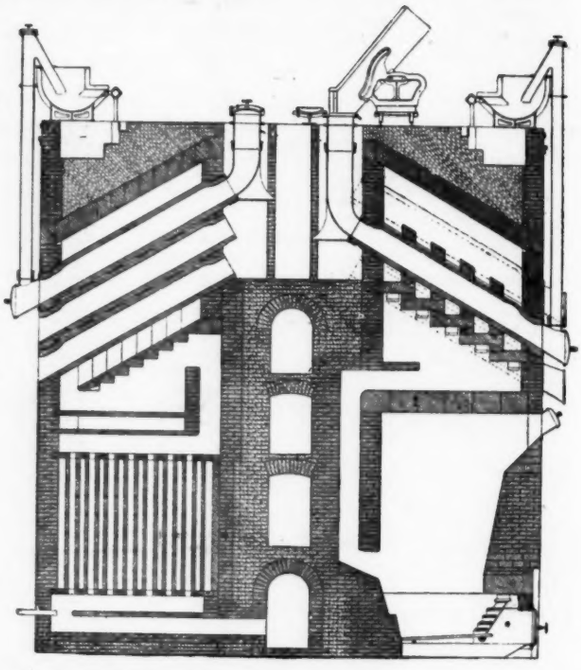

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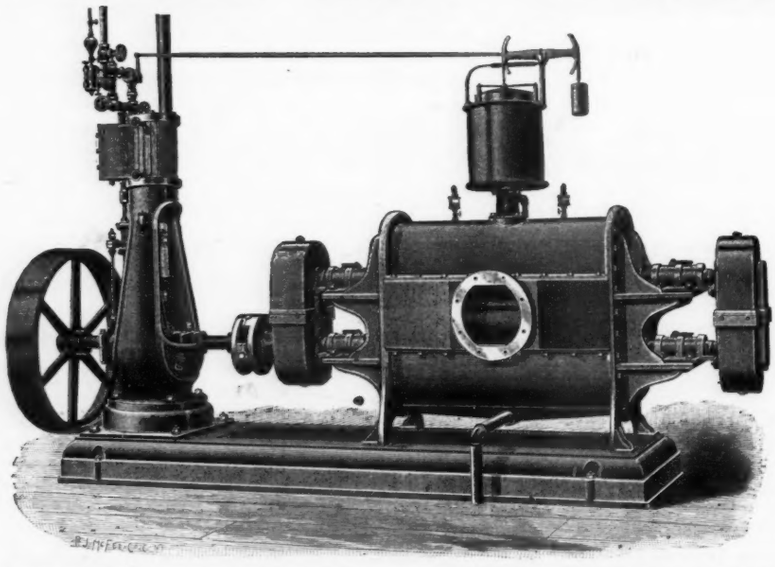

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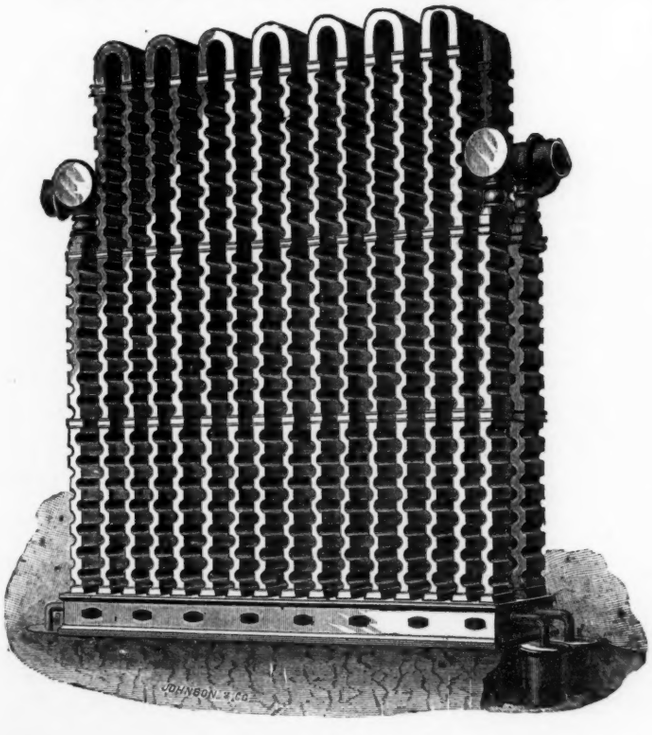

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Ashton-under-Lyne	1,250,000
Amsterdam	1,500,000
"	1,500,000
Annaberg	200,000
Arcachon	100,000
Animal Charcoal Co	200,000
Altoona, U.S.A.	350,000
Buxton	250,000
Bradford	1,000,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,000,000
"	1,000,000
"	3,000,000
Bremen	150,000
Baltimore, U.S.A.	1,000,000
"	1,000,000
"	1,000,000
Balmain, N.S.W	125,000
Bishops Stortford	150,000
Blackpool	400,000
Brussels	1,250,000
"	1,250,000
"	750,000
"	1,250,000
Banbury	250,000
Birmingham	5,000,000
Birkenhead	2,500,000
Blackburn	1,500,000
Bochum	600,000
Burntisland	250,000
Boston, U.S.A.	2,000,000
Brisbane	1,500,000
"	300,000
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"	20,000
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"	1,000,000
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Croydon	1,500,000
Copenhagen	200,000
Clevedon	200,000
Columbus, U.S.A.	500,000
Cincinnati, "	1,500,000
" "	1,500,000
Chicago "	3,000,000
" "	1,000,000
" "	1,000,000
Chemnitz	1,000,000
Crewe	1,250,000
Colonial Gas Works Co	100,000
Cadiz	300,000
Charlottenburg	600,000
Dudley	750,000
Driffield	100,000
Dukenfield	500,000
Dover	750,000
"	1,000,000
Deal	200,000
Derby	1,500,000

	Capacity. Cubic feet per day.
Dublin	3,000,000
Dowlais	100,000
Douai	500,000
Denton	500,000
Derby, U.S.A.	350,000
Denver, "	500,000
" "	1,000,000
Dusseldorf	750,000
"	500,000
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Darlington	1,250,000
Detroit, U.S.A.	750,000
Edinburgh	1,500,000
"	2,000,000
Enfield	300,000
Essen	300,000
Elbing	150,000
Falmouth	150,000
Frankfort	300,000
Farnworth	400,000
Fenton	400,000
Friedenshutte	500,000
Furth	400,000
Freiburg	200,000
Goole	250,000
Glossop	300,000
Guildford	300,000
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Grafton, N.S.W	100,000
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Heilbronn	200,000
Havana, Cuba	750,000
Hastings	1,500,000
Huddersfield	300,000
"	750,000
"	1,500,000
Hof	200,000
Hampton Wick	500,000
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"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	1,250,000
"	2,500,000
"	2,500,000
Silvertown	1,000,000
Bromley	2,000,000
"	1,500,000
"	1,500,000
"	1,500,000
"	2,000,000
"	1,500,000

LONDON—*Continued.*	Capacity. Cubic feet per day.
Shoreditch	2,500,000
Pancras	1,500,000
"	1,500,000
Pimlico	2,000,000
Nine Elms	3,000,000
"	3,000,000
South Metropolitan Co:—	
Greenwich	3,000,000
Woolwich	400,000
Vauxhall	3,000,000
"	3,000,000
Lea Bridge	300,000
West Ham	1,500,000
Leeds	2,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	3,000,000
"	2,000,000
Leominster	150,000
Leiden	500,000
"	600,000
Liverpool	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	2,000,000
"	3,000,000
Lincoln	1,000,000
"	600,000
Lowell, U. S. A.	1,000,000
Louisville "	1,500,000
Long Eaton	500,000
Lilie	900,000
"	450,000
"	750,000
"	250,000
"	250,000
Luckenwalde	330,000
Liegwitz	300,000
Lincoln, U. S. A.	250,000
Lawrence "	500,000
Lynn "	300,000
Lyons	1,500,000
Maidstone	1,000,000
Marseilles	1,500,000
"	1,500,000
Mons	500,000
Malines	250,000
Melbourne	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
"	1,500,000
Manchester	2,500,000
Middleton	400,000
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Minneapolis, U. S. A.	750,000
Magdeburg	300,000
Memphis, U. S. A.	750,000
Nottingham	1,250,000
"	2,500,000
"	2,500,000
"	2,000,000
"	1,500,000
"	2,000,000
Newport, U.S.A.	430,000
Newmarket	150,000
Newark, U.S.A.	680,000
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Numea, "	100,000
Namur	250,000
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Plymouth	2,000,000
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"	300,000
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"	2,500,000
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Reigate	200,000
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"	1,750,000
"	1,750,000
Smethwick	750,000
Sydney, N. S. W.	1,000,000
"	1,000,000
"	2,500,000
"	50,000
"	50,000
Sunderland,	1,500,000
St. Josephs, U.S.A.	250,000
Spa	100,000
Sevenoaks	300,000
St. Petersburg	2,000,000
"	1,500,000
St. Louis, U.S.A.	2,000,000
"	2,000,000
"	1,000,000
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"	600,000
Wellington	150,000
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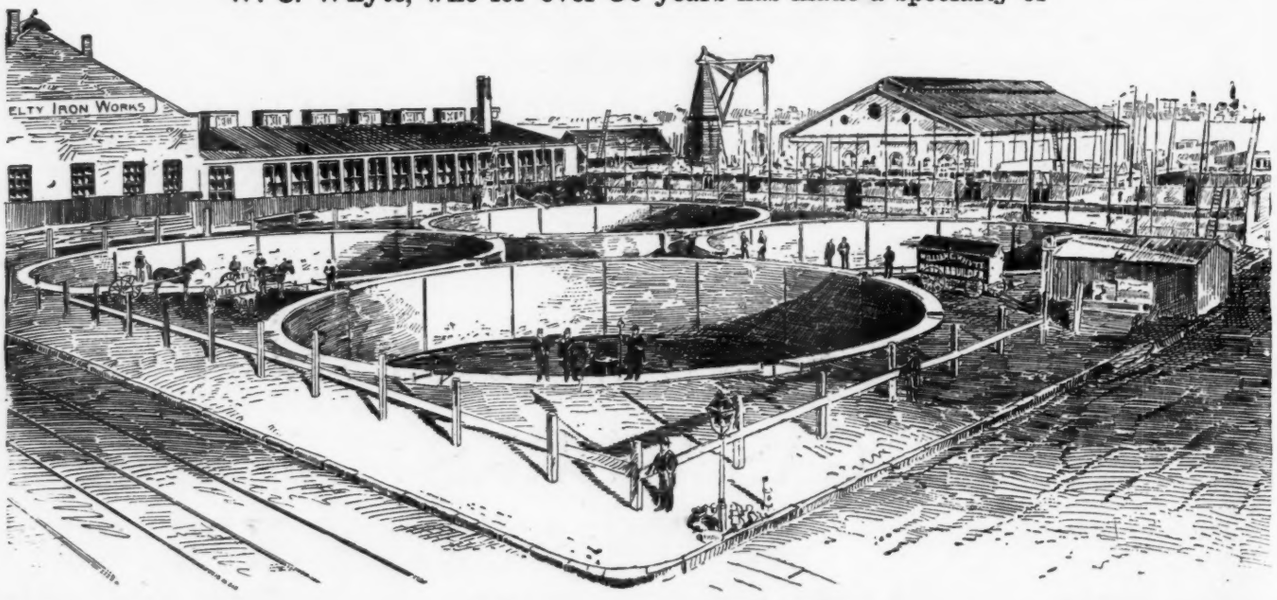

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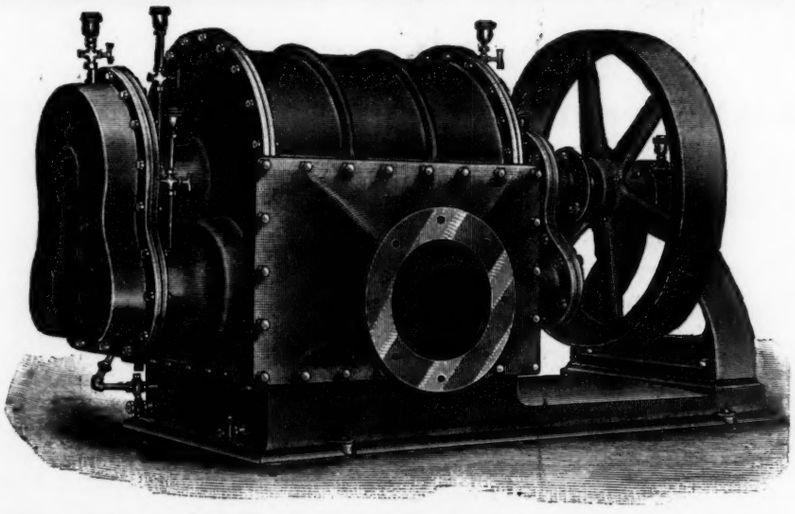

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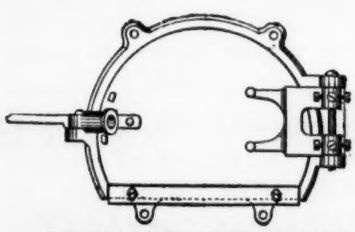

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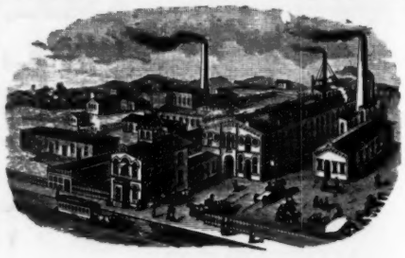

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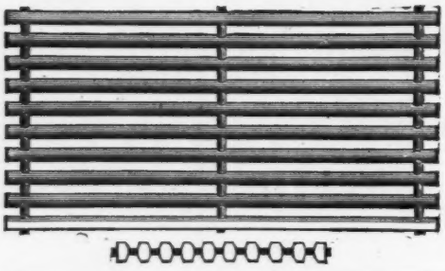

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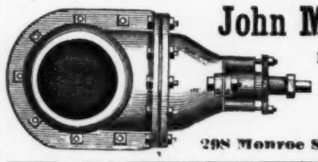

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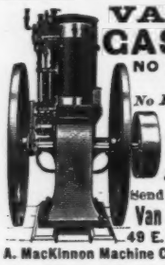

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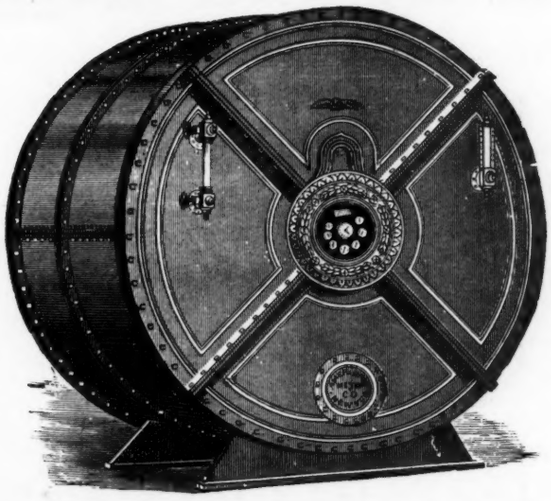

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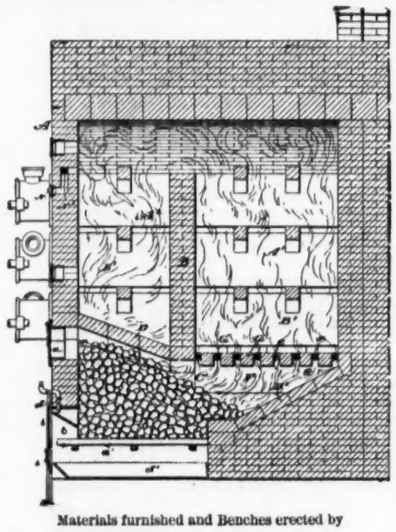

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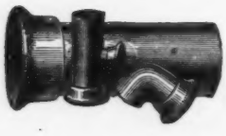

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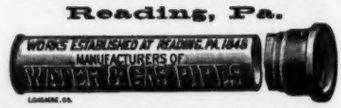

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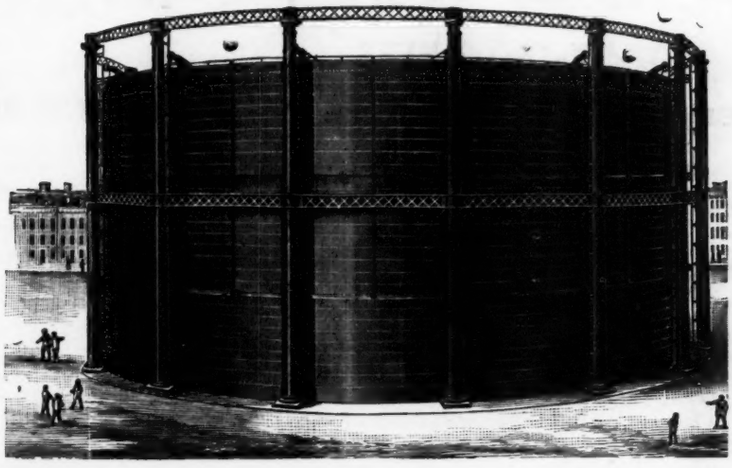

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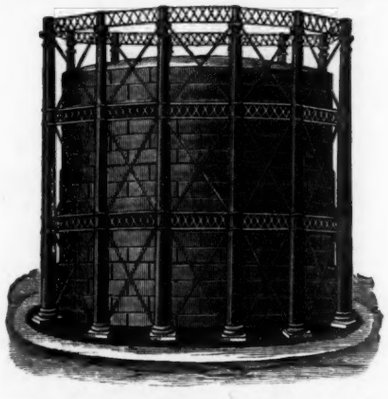

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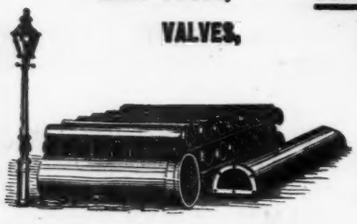

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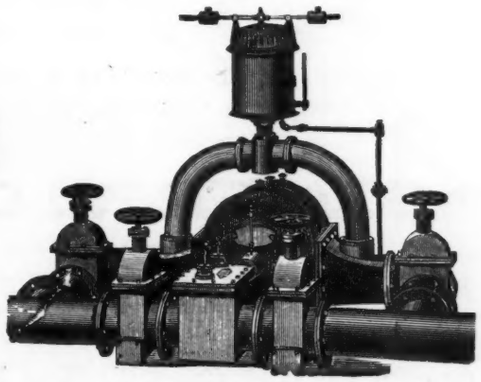

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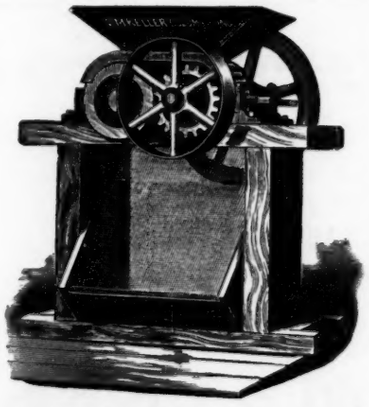

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BY THE

OTTO GAS ENGINES.

Gas Companies are given by the Otto Gas Engine superior means for Production of Power and Electric Light.

In Theory the Otto Gas Engine realizes 18 per cent. actual work out of number of heat units in fuel consumed, while the ordinary steam plants reach but 12 per cent. **In Practice** a comparison of cost in dollars and cents between gas and steam power stands as follows (the figures below being taken from actual experience):

50-H.P. STEAM ENGINE AND BOILER, Running a Plant of Fifty 2000-C.P. Arc Lamps 12 Hours.	
4,500 lbs. Indiana nut and slack, at $1.30 per ton	$2 93
Engineer, one night, at $50 per month	1 67
Trimmer, one day, at $40 per month	1 33
Superintendent or Electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent, one day, at $40 per year	11
Wheeling coal and removing ashes, at $4 per week	58
100 pairs carbons, at $18.50 per 1000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$10 38

50-H.P. OTTO GAS ENGINE, Running a Plant of Fifty 2000 C.P. Arc Lamps 12 Hours.	
9,200 cu. ft. gas, at 42 cts. per M. (for cost of gas see items below)	$3 86
Engineer not needed; engine is in care of Electrician or Supt.	....
Trimmer, one day, at $40 per month	1 33
Superintendent or electrician, one day, at $50 per month	1 66
Waste, etc., one day, at $20 per year	05
Water rent dispensed with (cooling water used over and over)	....
Handling of coal included in cost of gas	....
100 pairs carbons, at $18.50 per 1,000	1 85
One pint cylinder oil, at 60 cents per gallon	07
One quart engine and dynamo oil, at 50 cents per gallon	13
Total	$8 95

Expenses of depreciation, repairs, and interest omitted, being considered the same in both cases—though depreciation and repairs are much higher with steam on account of boiler and its appurtenances. Cost of gas in the holder we estimate for most of the Middle and Western States as follows: Coal, 30 cts.; labor, 20 cts.; purification, 2 cts.; total, 52 cts. Less coke, 7 cts., and tar, 3 cts.; leaving net cost of gas 42 cts. The items of Superintendence and repairs, being paid for by the gas sold to consumers, need not be charged on extra output for gas engine consumption. Where the cost of gas is higher than here figured, coal for steam use will be found proportionally higher, and final figures of comparison show same amount of saving.

Excess in Cost of Steam over Gas Power is thus $1.43, or nearly 16 per cent.

Coal for getting up steam and banking fires is not included in above figures, and should be added, thus increasing rate of economy of gas power beyond that shown by our figures.

Where Gas Companies adopt Gas Power for Electric Plants, Water Works, Sewerage, etc., they not only choose **the most economical power for their use,** but secure to themselves the **numerous advantages of increased production,** without increase of expense, and benefit thereby their entire manufacture. They induce consumers, by their example, to abandon Steam for Gas Power, and, by establishing special rates, make

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AND SOLVE AT ONCE THE QUESTION OF FUEL GAS.

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